THE YEAR BOOK *of* ORTHOPEDICS *and* TRAUMATIC SURGERY

(1959 1960 YEAR BOOK *Series*)

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With a Section on
PLASTIC SURGERY

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PUBLISHER'S NOTI

As noted in the Introduction to the 1958-59 YEAR BOOK Dr Edward L. Compere relinquished his editorship with the close of that volume. Dr Ralph K Ghormley was appointed editor but death brought to an end his all too-short tenure. Dr H H Young graciously volunteered to complete Dr Ghormley's work on the present volume and to accept an appointment as permanent editor We welcome Dr Young to our group of YEAR BOOK editors.

TABLE OF CONTFATS

The designation (1959 1960 Series used on the cover and title page of this volume is to indicate its publication during the "series year which begins in September 1959

PLASTIC SURGERY

INTRODUCTION

The editing of this volume of the YEAR BOOK has been done with feelings of mixed emotion Sadness came suddenly on the morning of June 6 1959 when the senior editor, Dr Ralph K Ghormley died suddenly following an acute coronary occlusion With his death the world lost one of its most distinguished orthopedic surgeons and orthopedic surgery lost one of its most illustrious scholars a talented teacher leader and friend To list his many accomplishments publications and the honors bestowed on him during his lifetime would in no way indicate the esteem with which he was held in the minds and hearts of those who knew and loved him

Doctor Ghormley entered the field of orthopedic surgery in its infancy while it was undergoing the growing pains of a new surgical specialty He often told the story of how while serving as a volunteer in orthopedic surgery during World War I he was frequently assigned to the duty of latrine inspection because the so-called orthopedic specialist was frowned on by the general surgeon who controlled the surgical fields He and many others were able to rise above this degradation and with their leadership established orthopedic surgery as a respected surgical specialty

Following World War I Doctor Ghormley went to Johns Hopkins to complete a 2 year residency in orthopedic surgery He then served as an intern at the New York Hospital and returned once more to Johns Hopkins for 1 year after which he entered the practice of orthopedic surgery in Boston From 1923 to 1929 he was an Instructor in Orthopedic Surgery at Harvard Medical School and was on the attending staff of Massachusetts General Hospital

In September of 1929 Doctor Ghormley joined the staff of the Mayo Clinic He was made Professor of Orthopedic Surgery in 1937 and in 1938 he became Head of the Section of Orthopedic Surgery a position he retained until 1955 when he was made a Senior Consultant He ultimately retired from practice in 1958 to live all too briefly in Carmel California

At the time of his death Doctor Ghormley was the sole editor of the YEAR BOOK. When he died, I entered the picture to complete the work that had been well started. Had Doctor Ghormley lived the predictions of the former editor Dr Edward L Compere might have come true. In the Introduction to the 1958-59 YEAR BOOK Doctor Compere predicted that under the direction of Doctor Ghormley the YEAR BOOK would become the most widely read reference book of the orthopedic surgeons of the world.

To complete the work I attempted to pick up the threads and carry on. I am proud to present this volume to you with Doctor Ghormley's name still listed as the senior editor. Many times I have wished for the counsel and advice that he would have given me. It is my hope that his ideals and his wise counsel of the past have served as a guiding hand in the completion of the volume. Often during its preparation I have thought of these words of Tennyson

And the stately ships go on
To their haven under the hill
But, O for the touch of a vanish'd hand
And the sound of a voice that is still!

An element of satisfaction entered my editorship of the YEAR BOOK—the review of the many hundreds of articles of orthopedic literature from throughout the world. There were numerous excellent monographs far too long for abstracting. These must be read in detail and in the original to appreciate the contributions that have been made.

There is little change in the format of the present volume compared with last year's. The chapter on Geriatric Orthopedics has been omitted since these articles seem better included in one of the more specialized chapters. Because of the tremendous upsurge of articles in orthopedic research and because of the added interest in basic research as it pertains to orthopedic surgery I have included a chapter on Experimental Orthopedic Surgery. There has been increased interest in the field of investigation of the circulation of bone and new efforts made for bone replacement and repair of fractures.

We are pleased to include in this volume the section on Plastic Surgery edited by Dr Neal Owens, Professor of

Clinical Surgery at Tulane University School of Medicine.

I wish to express my appreciation for guidance in the editorship of this volume of the YEAR BOOK to Mr William A Keville, Managing Editor of Year Book Publishers, and also to thank the following colleagues who commented on material in special chapters Dr John G Mayne for his comments on the articles in the chapter on Arthritis and Rheumatism Dr Edward D Henderson for his comments on the chapter on Paralytic Diseases Dr Paul R Lipscomb for his review and comments on the articles included in the chapter on the Hand and Wrist Dr John C Ivins for his comments on the new chapter on Peripheral Vascular Surgery and the chapter on Amputations and Prostheses and Dr G B Stickler for his comment on the Fanconi syndrome

We hope that you will receive this volume with the same enthusiasm that we have enjoyed in presenting the material to you

H HERMAN YOUNG

CONGENITAL AND HEREDITARY DEFORMITIES

Hereditary Disorders of Connective Tissue According to Victor A McKusick[1] (Johns Hopkins Univ) at least five conditions appear to be hereditary and generalized derangements of one or another element of connective tissue the Marfan syndrome the Ehlers Danlos syndrome osteogenesis *imperfecta pseudoxanthoma elasticum and the Hurler* syndrome

Patients with the Marfan syndrome are likely to show abnormalities in three areas in the eye especially dislocation of the lenses in the skeletal system particularly unusual length of the extremities (Fig 1) and in the cardiovascular system especially a weakness of the media of the aorta which may lead to diffuse aneurysm of the ascending aorta to dissecting aneurysm or to a combination of the two Inheritance seems to be that of an autosomal dominant trait but patients are seen fairly often who seem to represent new mutations

In the Ehlers Danlos syndrome there is hypermobility of the joints and hyperelasticity of the skin The skin is excessively fragile so that even minor trauma may cause widely gaping wounds Characteristic cigarette paper scars are seen at sites of trauma Hiatus hernia is not uncommon and diverticula of the gastrointestinal tract occur fairly often The connective tissue defect in this disorder appears to be an abnormal looseness of the collagen bundles

Osteogenesis imperfecta is a disorder of the organic matrix of bone leading to the classic liability to fractures of the sclera producing blue scleras and of other soft tissues resulting in loose jointedness hernia thin skin and other manifestations Dwarfism occurs in more severe cases the dentine of the teeth is likely to be affected and deafness is frequent Many pedigrees seem to fall into a dominant pattern of inheritance Some severely affected infants are born into families in which no other cases have occurred

Pseudoxanthoma elasticum causes degenerative changes

(1) Bull. New York Acad. Med 35 143-156, March 1959

in the skin particularly in the flexural areas of the neck axilla and groin Bruch s membrane of the fundus of the eye undergoes cracking resulting in angioid streaks Scar tissue grows into the fundus which with the bleeding that may occur leads to severe impairment of vision Massive gastrointestinal hemorrhage may occur as a consequence of con

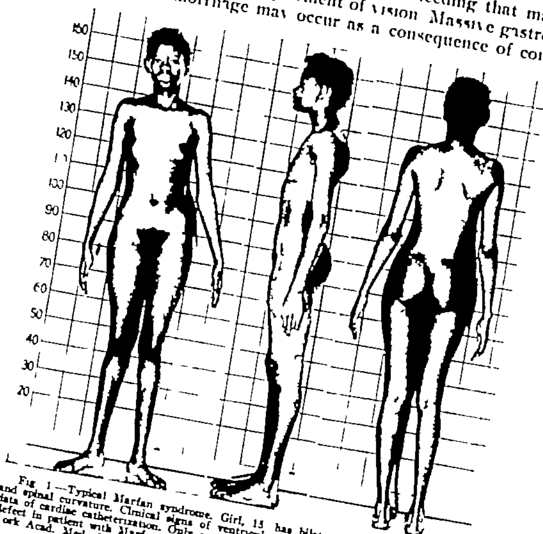


Fig 1—Typical Marfan syndrome. Girl, 15 has bilateral subluxation of lenses and spinal curvature. Clinical signs of ventricular septal defect a e corroborated by data of cardiac catheterization. Only case in author's experience (ventricula septal defect in patient with Marfan synd ome. (Courtesy of McKusick, V A. Bull. New York Acad. Med. 35 143 156, March 1959)

nective tissue changes in the blood vessels of the gastrointestinal tract The peripheral arteries undergo medial degeneration and peripheral and coronary arterial insufficiency may be a clinical feature Skin biopsy shows large amounts of material in the corium that stain like elastic tissue but may be degenerated collagen

In recent years the Hurler syndrome (Fig 2) has been considered an abnormality of mucopolysaccharide. The non cerebral manifestations include a characteristic dysostosis dwarfism stiff joints (claw hands reduced mobility of large joints) and hernia The liver and spleen become enlarged

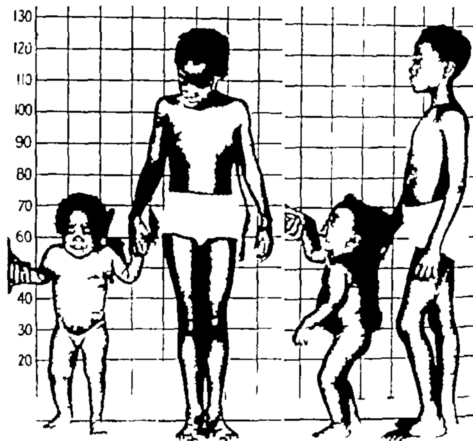


Fig 2—Hurler syndrome On left of each view girl, aged 2½ is member of only Negro family with Hurler syndrome author has seen. Head is large and facies characteristic of syndrome Elbows, shoulders, knees and other joints have reduced mobility preventing full extension. Hands are short and terminal phalanges cannot be fully extended. Liver and spleen are enlarged. Nasal breathing is obstructed by continuous mucopurulent discharge. Both corneas are clouded. Of 6 children, 3—2 boys and this girl—have been affected with autosomal recessive form of Hurler syndrome. Normal sister age 8 is also shown. Two other affected children died aged 3 and 4 years (Courtesy of M Kunick V A. Bull. New York Acad. Med. 35 143 156, March, 1959)

due to deposit of mucopolysaccharide. Similar deposits occur in the intima of the cardiovascular system The cerebral aspects of the disease manifested mainly as progressive impairment of mental function have not been correlated with the nonnervous system aspects to the author s complete satisfaction It is possible that an enzymatic mechanism common to brain and connective tissue is faulty or one of the

mucopolysaccharides produced in excess may be toxic to the brain.

Aneurysmal Venous Dilatation in Marfan's Syndrome affecting a neck vein was observed by Nasip Tuna[2] (Univ. of Minnesota) in a man aged 42 who also had venous varicosities, intractable stasis ulcer of the leg and testicular atrophy.

Marfan's syndrome has been accepted as an hereditary disorder of the connective tissue, with widespread malformations of the musculoskeletal, cardiovascular and ocular systems. The exact cause and pathogenesis is not known. Of special interest is the experimental production in rats fed Lathyrus odoratus seeds of musculoskeletal and cardiovascular changes similar to those noted in patients with Marfan's syndrome.

A variety of manifestations associated with this syndrome have been reported. In the musculoskeletal system those most frequently observed are dolichostenomelia, dolichocephaly, high arched palate, cleft palate, pectus excavatum, pectus carinatum, kyphoscoliosis, spina bifida, hemivertebra, winged scapula, hyperextension and subluxation of the joints, pes planus, hernia and muscular hypotonia. The commonest manifestations in the cardiovascular system are diffuse aneurysm of the aorta, dissecting aneurysm of the aorta, coarctation of the aorta, aneurysm of the innominate and common carotid arteries, patent ductus arteriosus, dissecting aneurysm of the pulmonary artery, congenital and idiopathic dilatation of the pulmonary artery, involvement of the semilunar valves, aneurysmal dilatation of the aortic sinuses of Valsalva, involvement of the atrioventricular valves and chordae tendineae, patent foramen ovale, interatrial septal defect, tetralogy of Fallot and varicose veins. The associated conditions in the ocular system include ectopia lentis, coloboma of the lens, retinal detachment and abnormalities of the lens and cornea (microphakia, spherophakia, megalocornea, microcornea and keratoconus); in the pulmonary system susceptibility to respiratory infections, developmental malformations of the lung, cystic disease of the lung and spontaneous pneumothorax; and in the renal system ectopic kidney with hydronephrosis, polycystic kidneys and atresia of the ureter.

(2) Dis. Chest, 36:204-208, August, 1959

Arthrogryposis Multiplex Congenita Newton G Mead William C Lithgow and Howard J Sweeney[3] (Shriners Hosp for Crippled Children Chicago) present a study of arthrogryposis multiplex congenita that is based primarily on findings in 40 patients who were examined and treated and on whom close follow up was possible

The cause and pathology of arthrogryposis are not well understood and there is no general agreement concerning them The primary pathologic site may be in the spinal cord or in the muscles Fibrosis around the joints and in the subcutaneous tissues is part of the pathologic process and not merely secondary to intrauterine inactivity Occurrence of *the disease in 1 member of each of 4 sets of identical twins* (2 of the sets of twins were in this series) excludes hereditary factors as the cause and casts doubt on the theories of intrauterine mechanical circulatory and toxic causes Negative family histories further tend to exclude the theory that heredity is a cause

Mental deficiency is infrequent among patients with arthrogryposis When mental deficiency is present it is coincidental Of the study group 2 patients were below normal in intelligence 1 had cerebral palsy also Several had high intelligence Several had finished high school and some had completed college

Most deformities caused by arthrogryposis are difficult to correct The unyielding fibrous thickening around the joints or the tense skin may prevent successful manipulation Patience in efforts to stretch these structures slowly with casts will generally be rewarding Lack of muscles may render a joint useless even though considerable free motion is present Open surgical release of fibrous contractures may fail because the vessels and nerves cannot tolerate the tension necessary for adequate correction of the deformity or the inelastic skin may not be sufficiently mobile to permit closure of the operative wound after the contracture has been released. However such discouraging factors should not deter the surgeon from making an earnest attempt at correction when correction is indicated

Many arthrogrypotic deformities do not require treatment. Certain deformities however usually require treatment. The commonest of these is clubfoot which inevitably

(3) J Bone & Joint Surg. 40 A 1285-1309 December 1958.

progresses as growth and improper weight bearing exert their effects If the result of treatment is a short rigid painless foot in good weight bearing position treatment is successful In some types of feet astragalectomy gives better results than does fusion This operation has the advantage of correcting calcaneus deformity and extreme equinovarus deformity and can be performed earlier than triple arthrodesis

The knee joint also requires treatment when badly deformed or unstable. End results of surgical treatment of the hips are uncertain Results of treatment of the upper extremities have been satisfactory when indications for surgery were clear A hand rendered useless by contracture can have good results from carefully planned procedures Wrist joint deformities have given good results with fusion operations but care should be taken that the wrist fused in a functional position enables the patient to care for personal needs Placing one elbow in about 90 degrees of flexion may be an improvement when extension deformities are present. Surgical treatment of the shoulder is rarely advisable

► [Very little can be added in the way of comment on this excellent paper Practically all deformities seen have been illustrated and indeed the rehabilitation of these patients has been most commendable. Anyone who has had occasion to treat but one of these patients realizes the marked handicap under which they live and anything that can be done for them to make them more self reliant is commendable. Unfortunately no one patient presents the same problem as another and the treatment of each one must be planned well in advance. However these unfortunate people do need care and often with a series of well planned operative procedures many of them can be rehabilitated. The rehabilitation may take the form of plastic procedures on the skin tendon transferences, osteotomies arthrodeses, capsulotomies, etc. Although at the time the patient is first seen the problem may seem insurmountable, there is nothing more gratifying than to see these helplessly crippled people become ambulatory and self sufficient.—Ed.]

Congenital Absence of Odontoid Process of Axis Report of Case is presented by E. L. Gillman[4] (Long Beach Calif.)

Man, 42 was examined because of a low neck injury A transoral view of the cervical spine showed no odontoid process. Anteroposterior and lateral planigrams demonstrated a rudimentary dens (Fig 3) and mild lateral and posterior subluxations of the axis. Because there were no symptoms referable to the condition, no therapy was recommended other than precaution against serious trauma to the head, such as might occur in diving tumbling or wrestling X rays 18 months later showed continuing asymptomatic subluxations of the atlas on the axis laterally and posteriorly

(4) J Bone & Joint. Surg. 41 A 345-348 March, 1959

In the 21 cases of congenital malformation of the odontoid process reported in the literature trauma brought attention to the condition There was total absence of the dens in 14 patients agenesis or hypoplasia in 3 and os odontoideum [separate ossicle—Ed] in 4 Dislocation of the atlas on the axis was noted in 12 patients In 1 patient there was sub-



Fig 3 —Planigram showing rudimentary dens and mild subluxation to right of 2d cervical vertebra (Courtesy of Gillman, E. L. J Bone & Joint Surg, 41 A 345-348, March, 1959)

luxation Excessive mobility of the atlas and axis was reported in 3 patients

Instability of the atlantoaxial joint secondary to an absent or aplastic odontoid process not associated with other malformations in itself presents a less grave hazard to health or life than might be expected The abnormally mobile joint does not necessarily give rise to symptoms Rather due to absence of the dens preternatural mobility of the joint is entirely compatible with the safety of the medulla. However should such abnormal mobility occur with an intact dens medullary damage or death would most certainly ensue

Gillman believes that the defective unstable joint in patients with malformation of the odontoid process is not an indication in itself for fusion of the joint which is a highly formidable procedure

► [The author draws attention to interesting congenital abnormalities which I am sure few persons have observed. Theoretically if the odontoid process is not present then the conclusion reached by the author that the abnormal mobility does not give rise to a dangerous situation as far as the spinal cord is concerned is feasible for it is the presence of the odontoid process pressing on the cord when the odontoid process is fractured, and the first cervical vertebra dislocated, that gives rise to the neurologic findings. The fusion operation fusing the first cervical vertebra to the second is a difficult procedure because of the lack of bone mass present and often one has to attempt to fuse from the occiput to the second or third cervical vertebra to stabilize this joint. These operations are formidable procedures and fusion is often difficult to obtain.—Ed.]

Congenital Posterior Angulation of Tibia with Talipes Calcaneus Long Term Report of 11 Patients Congenital posterior or posteromedial angulation of the tibia with talipes calcaneus is characterized by posterior angulation or backward and medial bowing at the junction of the middle and lower thirds of the diaphysis of the tibia with similar bowing of the fibula severe talipes calcaneus tightness of the anterior muscles of the leg and weakness of the triceps surae presence of a dimple over the apex of the angulation shortness of the leg and underdevelopment of the leg muscles no detectable abnormality of the bone structure other than a thickening of the cortex on the concave side of the curve no unusual tendency to fracture no appreciable impairment of the upper or lower tibial epiphysis and good prognosis with conservative treatment.

Clarence H Heyman Charles H Herndon and Kingsbury G Heiple[5] (Elyria O Mem'l Hosp) observed 11 patients with congenital posterior angulation of the tibia from infancy All were treated conservatively Therapy during the first few months after birth was directed only to the severe calcaneus and consisted of massage and stretching of the soft tissues which held the foot in the calcaneus position In some patients a simple molded plaster splint was applied over the anterior aspect of the leg and dorsum of the foot while the foot was held in plantar flexion. The splint was held in place by an elastic bandage It was removed by the mother for manipulations of the foot and ankle and then replaced A brace was applied as early as was practical at about age 5 or

(5) J Bone & Joint Surg. 41 A 476-488 April, 1959



Fig. 4 (top).—Severe posteromedial bowing of left tibia and fibula at junction of middle and lower thirds, with shortening of 1 in., in girl, aged 8 months.

Fig. 5 (bottom).—Same patient at age 17 years 9 months. Epiphysiodesis of upper tibial and fibular epiphyses of right leg was done 6 years previously—too late to be of benefit. Fusion of epiphysis of tibia was asymmetrical.

(Courtesy of Heyman, C. H. et al.: J. Bone & Joint Surg. 41-A: 476-488, April, 1959.)

6 months or just before the child began to stand It was worn during the day until bowing of the tibia was well corrected by growth the calcaneus deformity eliminated by relief from contracture and strength appeared in the triceps surae

Angulation or bowing of the leg was completely corrected or is only slight in all 11 patients treated (Figs 4 and 5) Calcaneus deformity was completely corrected and there is no demonstrable weakness of the triceps surae muscles The feet are one or two shoe sizes smaller than normal and the circumference of the legs is somewhat smaller than normal There is no measurable shortening of the femora and no difference in circumference of the thighs

► [Posteromedial bowing of the tibia and fibula should never be confused with the congenital anterior angulation and pseudarthrosis of the tibia. Serious complications may arise from the latter while there are practically no serious complications from the posteromedial angulation. Most of these correct spontaneously and it is doubtful whether a brace is even necessary As the authors point out, the one complication that does develop is the shortening of the leg which can be taken care of quite adequately by an epiphyseal arrest.—Ed.]

Congenital Flatfoot Due to Talonavicular Dislocation (Vertical Talus) is discussed by Samuel B Haveson[6] (Univ of California) Although the etiologic factors of talonavicu-

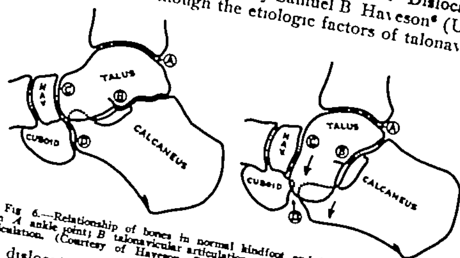


Fig 6.—Relationship of bones in normal hindfoot and in talonavicular dislocation A ankle joint; B talonavicular articulation C subtalar joint D, calcaneocuboid articulation. (Courtesy of Haveson, S. B Radiology 72 19 25 January 1959)

lar dislocation of the hindfoot (Fig 6) are not known with certainty the following sequence of events may be assumed The distal portions of the calcaneus and talus rotate toward the plantar surface the talus rotating into a vertical position. The subtalar joint apparently remains intact but the plane

(6) Radiology 72 19 25 January 1959

of this joint assumes a more vertical position than normal (Fig 6 *B*) Rotation of the distal talus and calcaneus toward the plantar surface results in medial rotation of the talus and eversion of the calcaneus at the subtalar joint The head of the talus is therefore directed medially and infe



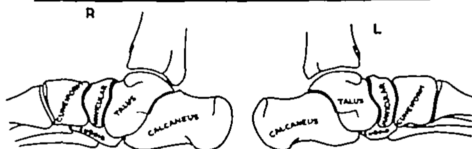


Fig 7 —Lateral projections and tracings. Right foot is uppermost. Talar head is directed toward plantar surface, and abnormal articulation of navicular with neck of talus is demonstrated. Distal calcaneus is rotated toward plantar surface, and there is slight calcaneocuboid separation. Note irregularity of articular surface of navicular opposing neck of talus and wedge-shaped deformity of navicular Only posterior portion of superior articular surface of talus articulates with tibiofibular mortise. (Courtesy of Harrison, S D Radiology 72 19 25 January 1959)

riorly The vertical position of the talus allows only the posterior portion of its superior articular surface to articulate with the tibiofibular mortise (*A*) A dislocation of the talonavicular joint occurs resulting in abnormal articulation of the navicular with the superior surface of the neck of the talus (*C*) and widening of the calcaneocuboid joint (*D*)

Thus a relative dorsiflexion of the forefoot occurs at the transverse tarsal joint.

Diagnosis in the older child and adult is easily made by x rays A lateral projection of the foot reveals the characteristic vertical talus, the articulation of the navicular with the superior surface of the neck of the talus and rotation of the distal calcaneus toward the plantar surface. The calcaneocuboid separation is more striking in the younger patient diminishing as adaptive changes occur in the maturing foot. Medial displacement of the distal talus and abduction of the forefoot are demonstrated on the dorsoplantar projection (Fig 7) The forces exerted on the navicular may result in decrease of its longitudinal diameter and irregularity of the articular surface opposing the talus. A wedge shaped deformity of the navicular may eventually occur with the apex of the wedge directed inferiorly Medial displacement of the navicular in an adult patient (Fig 7) was an unusual finding

Osteotomy in Treatment of Congenital Dislocation of the Hip According to David Trevor[7] (London) anteversion in all patients with congenital dislocation of the hip must be corrected surgically Before operation the head of the femur must be reduced into the acetabulum and the hip joint must be capable of being internally rotated. Rotation osteotomy is a final step in the surgical program.

TECHNIC.—The femoral shaft is approached laterally the skin incision directed forward. The femur can be divided in the subtrochanteric or supracondylar regions. Subtrochanteric osteotomy is done at a site that is easily accessible and convenient for internal fixation. Division of the bone is nearer the site of the deformity and any valgus deformity can be corrected at the same time. Supracondylar osteotomy has the advantage that the hip joint need not be immobilized postoperatively a toe to-groin cast being adequate. The femur is transfixed by a Steinmann pin at the base of the great trochanter with the hip joint held firmly in full internal rotation. Two marks are made on the femur which then is divided cleanly between these marks. The marks help to indicate the amount of derotation effected. After the femur is divided, the lower fragment is rotated outward until the knee is in neutral position. A plate and four screws are used for internal fixation. Alternatively Steinmann pins transfixing the two fragments can be incorporated in the plaster Immobilization in a full single hip spica for 8 weeks is adequate.

When there is in addition a valgus deformity after derotation a small wedge with the base medially is removed from the upper end of the lower fragment (Fig 8) The limb is adducted to close the gap

(7) Proc. Roy Soc. Med. 51:1045-1048, December 1958.

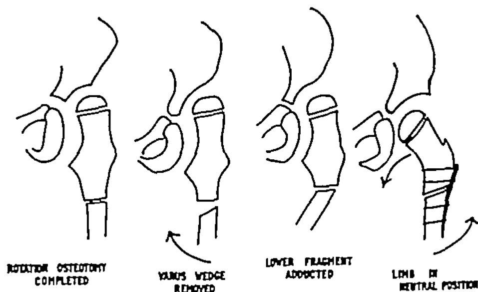


Fig 8.—Method of correcting simultaneously anteversion and valgus deformity of femoral neck. (Courtesy of Trevor D: Proc. Roy. Soc. Med. 51 1045-1048, December 1958.)

and a strong stainless steel plate bent as necessary is applied. On bringing the limb back to neutral position the femoral head is brought down into its correct position in the acetabulum

Trevor performed rotation osteotomy for dislocation of the hip many times during the past 17 years The amount of correction obtained at operation varied from 30 to 90 degrees Osteotomy being the last stage in treatment followed such procedures as open reduction and/or acetabuloplasty capsular arthroplasty or closed reduction On three occasions the deformity recurred necessitating further osteotomy

► [The correction of moderate and severe anteversion in patients with congenital dislocations of the hip has been emphasized in more recent years. Undoubtedly nearly all patients with congenital dislocation of the hip present some anteversion to a greater or lesser extent. I would agree with the author that the moderate and particularly the severe anteversions need surgical correction. However to rely on the four hole plate to hold the osteotomy is to my way of thinking rather precarious. I much prefer the use of a small blade or Blount plate for securing of the fragments at the osteotomy site. If the blade or Blount plate is used earlier mobilization with a sense of security can be instituted.—Ed]

Osteochondritic Changes in Head of Femur after Reduction of Congenital Dislocation of Hip are one cause of poor results in treatment of this disorder It has been thought that osteochondritis is due to trauma of reduction and to pressure of the head against the acetabulum Hence it is argued that prolonged traction should be used in all cases after reduction However in a group of patients with typical con

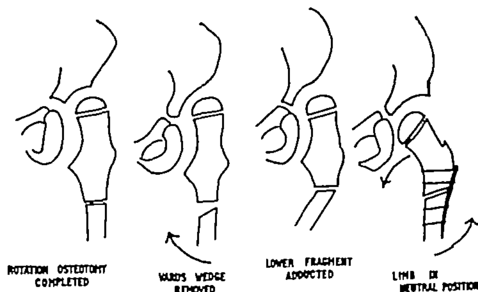


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► [The correction of moderate and severe anteversion in patients with congenital dislocations of the hip has been emphasized in more recent years. Undoubtedly nearly all patients with congenital dislocation of the hip present some anteversion to a greater or lesser extent. I would agree with the author that the moderate and particularly the severe anteversions need surgical correction. However to rely on the four hole plate to hold the osteotomy is to my way of thinking rather precarious. I much prefer the use of a small blade or Blount plate for securing of the fragments at the osteotomy site. If the blade or Blount plate is used earlier mobilization with a sense of security can be instituted.—Ed]

Osteochondritic Changes in Head of Femur after Reduction of Congenital Dislocation of Hip are one cause of poor results in treatment of this disorder It has been thought that osteochondritis is due to trauma of reduction and to pressure of the head against the acetabulum Hence it is argued that prolonged traction should be used in all cases after reduction However in a group of patients with typical con

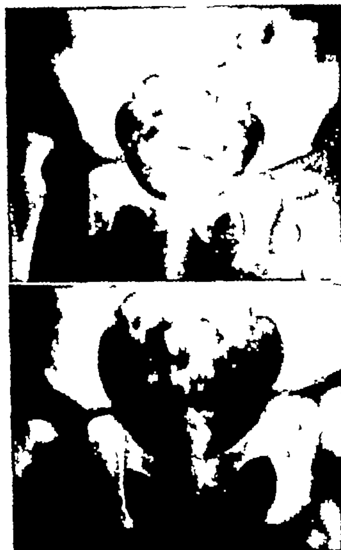


Fig. 9 (top) —Girl, aged 15 months, with unilateral congenital dislocation of hip.
Fig 10 (bottom) —At 37 months after reduction head has almost completely disappeared but is well placed in acetabulum.
(Courtesy of Kite, J H. South. M J 52 945 951 August, 1959)

genital dislocation of the hip J Hiram Kite[3] (Atlanta, Ga) observed osteochondritis as often in those who had traction as in those in whom reduction was achieved without traction. Osteochondritis occurred in 7 of 32 patients (22%) whose hips were reduced after traction and in 11 of 65 (17%) who had no traction In this study only when there was a well formed head before reduction (Fig 9) which degenerated (Fig 10) and later regenerated was the term 'osteochondritis or 'aseptic necrosis" applied.

(3) South. M J 52 945-951 August, 1959

Kite suggests that osteochondritis after reduction of congenital dislocation of the hip may be due to atrophy of the muscles resulting from long immobilization in casts It has been shown that the stress stimulus is the most important factor in stimulation of bone growth Throughout the skeleton, mechanical stress is apparently necessary to convert primitive bone into the adult type. In the presence of disuse atrophy of the muscles the stress stimulus is lacking If atrophy is the most important factor in the production of osteochondritis it is permissible to reduce the hips that can be reduced easily without traction In all cases in which reduction is difficult traction should be used

Congenital Muscular Torticollis in Infancy Some Observations Regarding Treatment are presented by Mark B Coventry and Lloyd E Harris[9] (Mayo Clinic and Found) Among 19 girls and 16 boys (Table 1) the tumor in the sternocleidomastoid muscle was discovered at average age of 3½ weeks and disappeared at average age of 3½ months

TABLE 1—Sex Birth Presentation and Side Involved in 35 Patients

	No. of Patients
Sex	
Female	19
Male	16
Presentation	
Breech	14 (40%)
Vertex	21 (60%)
Side of sternocleidomastoid tumor	
Right (9 breech, 7 vertex)	16
Left (4 breech, 14 vertex)	18
Bilateral	1

The longest period between the time of appearance and disappearance of the tumor was 5 months.

Asymmetry of the face and skull though occasionally present at birth was usually not evident until age 2½ months Thus facial asymmetry did not usually appear until about 1½ months after the tumor appeared in the sternocleidomastoid muscle The asymmetry tended to disappear for the most part but usually not completely by age 6 months

Residual wryneck was present in 2 of the 35 patients (Table 2) All others had excellent results The 2 with poor re-

(9) J Bone & Joint Surg 41 A 815-822, July 1959

sults were among the 5 patients who were treated surgically

It is often said that no tumor exists in infants with well-established wryneck and that there may be two entities, one with tumor and one without. More accurately, it should be stated that there is no history of tumor in many patients with wryneck.

There is no justification for operating on all patients with congenital muscular torticollis in infancy. If there is a detectable wryneck deformity with contracture of the sterno-

TABLE 2.—RESULTS OF TREATMENT

THERAPY	EXCELLENT	POOR
Physical	24	
None	6	
Surgical*	3	2
Total	33	2

*3 had preliminary physical therapy. 2 had no preliminary treatment.

cleidomastoid muscle after age 1 year, this muscle should be sectioned then because the deformity at that age may be permanent. However, there is every indication that an operation at any age up to 12 will give as good result as an operation at any earlier age. If the operation is properly carried out there should be no residual neck deformity, except for atrophy of the sectioned muscle which will occur if an operation is done at any age. The asymmetry of the skull and face will correct itself as long as growth potential is present. The child will grow and these bones will be reshaped when there is no deforming pull of a tight sternocleidomastoid muscle.

METABOLIC DISEASES OF BONE

Calcium Metabolism. Eugene Eisenberg[1] (Univ. of California) states that the mechanism of maintenance of the serum calcium level is one of the basic questions of calcium metabolism. Among the factors involved are intestinal absorption of calcium, physiochemistry and rates of calcium transport and excretion, role of bone in maintenance of the serum calcium balance and influence of parathyroid hormone in calcium metabolism.

(1) Kaiser Found. M. Bull. 6:305-312, Oct.-Dec., 1958.

Studies of these factors have already led to refinements in diagnostic and therapeutic procedures and may be expected to have more significant results in the future One of the newer diagnostic procedures found useful in cases of suspected hyperparathyroidism is assay of the tubular reabsorption of phosphorus In normal subjects on an ordinary diet (and in subjects with osteoporosis or urolithiasis who are not hyperparathyroid) tubular reabsorption of phosphorus proceeds at a given rate—80-90% In the hyperparathyroid subject tubular reabsorption of phosphorus is decreased as long as the quantity of phosphorus ingested is relatively constant the large renal excretion results in a fall in serum phosphorus

Phosphorus deprivation in the normoparathyroid subject results in a rise in tubular reabsorption of phosphorus by the 3d day to levels exceeding 88% The serum phosphorus level may fall but not significantly and urinary excretion of phosphorus is equal to or less than the intake. In the untreated hypoparathyroid subject tubular reabsorption of phosphorus exceeds 90% with or without a low phosphorus intake In the hyperparathyroid patient with low phosphorus intake tubular reabsorption of phosphorus rises but not so high as in normal subjects The diagnosis of hyperparathyroidism may be overlooked if the physician fails to consider that the tubular reabsorption of phosphorus of a patient with this disorder may fall within the normal range (as high as 85%) while the diet is low in phosphorus or the patient is receiving a medication such as aluminum hydroxide gel that renders the ingested phosphorus insoluble.

Defective Absorption of Phosphorus and Calcium and Effect of Vitamin D in Fanconi Syndrome were studied by H E F Davies Byron Evans H M N Rees and P Fourman[2] The outstanding clinical manifestations of the Fanconi syndrome in adults are potassium deficiency and osteomalacia. The potassium deficiency is produced by excessive urinary loss but it is by no means clear whether this results from the acidosis which these patients often have or whether it is a primary defect in the tubular conservation of potassium

The osteomalacia is characterized by diminished bone

(2) Guy Hosp Rep. 107 486-499 1958.

density spontaneous fractures Looser's nodes and in the blood a normal level of calcium but an abnormally low level of inorganic phosphate The abnormally low level of inorganic phosphate has been attributed to the excessive urinary loss of phosphate and it has been held to account for the failure of normal bone formation As in other forms of phosphate diabetes the osteomalacia responds only to large doses of vitamin D

Woman aged 44 had potassium deficiency osteomalacia and aminoaciduria. She was not acidotic and excretion of hydrogen ion was normal when she was not deficient in potassium Her kidneys failed to conserve potassium and phosphate Intestinal absorption of phosphate and calcium was also impaired. With large doses of vitamin D phosphate absorption increased calcium absorption improved to a lesser extent. With this treatment the osteomalacia healed the blood levels of phosphate were occasionally extremely high

Though the patient's glomerular filtration rate was normal the biochemical abnormalities particularly the excessive urinary loss of potassium and aminoaciduria show that she had diseased renal tubules The explanation often given for the excessive loss of potassium in renal tubular acidosis that it is cation lost in place of hydrogen ion does not always apply and it cannot apply to this patient because she was not acidotic The excessive loss of potassium must represent an independent tubular defect Her initial failure to acidify the urine normally was a secondary defect of tubular function because it was restored to normal by potassium repletion Normal subjects are similarly unable to acidify the urine normally when they are potassium depleted.

► [The full name of this syndrome should be the deToni Debré Fanconi syndrome since it was described by all three of these authors This is unimportant because I personally abhor calling any syndrome by a proper name. It would be better if all medical conditions could be described in anatomic or physiologic terms.

It should be called to the attention of the authors of this paper that Salassa, Powers Ulrich and Hayles (*Proc. Staff Meet. Mayo Clin.* 29 214 1954) showed that vitamin D administration increased the phosphorus and calcium absorption from the gastrointestinal tract in 2 patients who had this syndrome. It is also important to mention that the insulin clearance fell following administration of high doses of vitamin D indicating a decreased glomerulofiltration rate in 1 patient with this same syndrome This was reported by Worthen and Good (A M A. J Dis. Child 95 653 1958) —Gunnar B Stickler]

Osteopetrosis Associated with Rickets and Scurvy is reported by E H Back and W R. Cole[3] (Univ College Hosp

(3) Brit. J Radiol. 31 709 711 December 1958.

of the West Indies Jamaica) An unusual case is presented. Girl aged 15 months had films of the skeleton which showed marked uniform increased density of all bone areas normally ossified before birth (Fig 11, *A*) The left humerus and left femur (Fig 11 *B*) had oblique fractures consistent with birth injuries and suggesting increased bone fragility *Bone* which had formed since birth was of very different type with a coarse granular appearance of lesser density probably scattered throughout a matrix of deficient ossification This was well seen at the growing ends of the long bones about the epiphysial centers at the knees (Fig 11 *C*) and the talus and os calcis of the ankles There was a well marked organizing periosteal reaction along the bone shafts This also showed ossification of

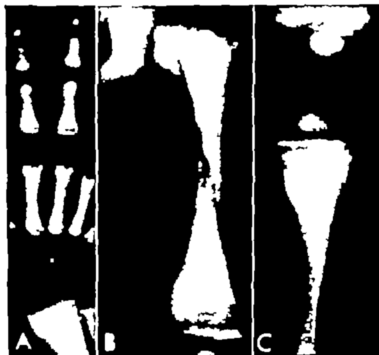


Fig 11 (Courtesy of Back, E. H., and Cole W R. Brit. J Radiol. 31 709-711 December 1958.)

the granular type. These appearances suggested a second abnormal type of ossification with a distribution and character similar to the process seen in healing scurvy The x ray evidence of scurvy was confirmed by a positive vitamin C saturation test and improvement in the x ray picture on therapy The patient had biochemical evidence of rickets with low normal serum calcium low serum phosphate, markedly diminished calcium-phosphorus product and raised alkaline phosphatase but x ray evidence was minimal.

Radiology for Practicing Physicians Infantile Rickets, Scurvy and Congenital Syphilis Paul C Hodges[4] (Univ of

(4) Postgrad. Med. 24 A55 61 December 1958.

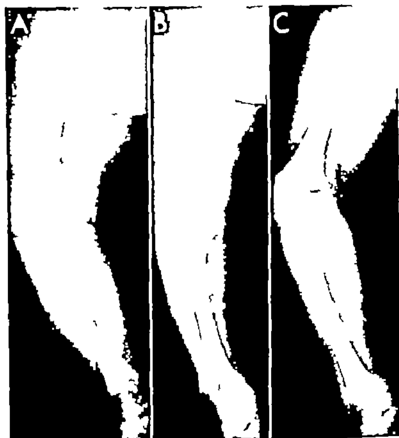


Fig 13 Mild scurvy in girl, aged 10 months. Although the patient had been given vegetables and orange juice mother believed most had been vomited. A mode ate generalized osteoporosis white line at distal end of femur and tibia. B 9 days after institution of vitamin C C after 17 days therapy reconstruction is occurring t ends of fem and tibia. Apparently there has been no subperiosteal hemorrhage. (Courtesy of Hodges P C. Postgrad. Med. 24 A55-61 December 1958)

ets there is no osteoid tissue and therefore no gap between shaft and epiphysis Unlike syphilis the condition is never seen before the 3d month of life

X ray changes due to congenital syphilis may be present at birth and if so they become more noticeable within a few weeks They constitute a low grade osteomyelitis which is seldom mistaken for pyogenic osteomyelitis Unlike scurvy generalized osteoporosis is mild or absent and there is apt to be subperiosteal proliferation of bone even in the absence of therapy (Fig 14) Breakdown of the cortex at the junction of the shaft and metaphysial plate is not unlike that seen in scurvy It is sometimes difficult to distinguish the two diseases on the basis of x ray findings alone but usu

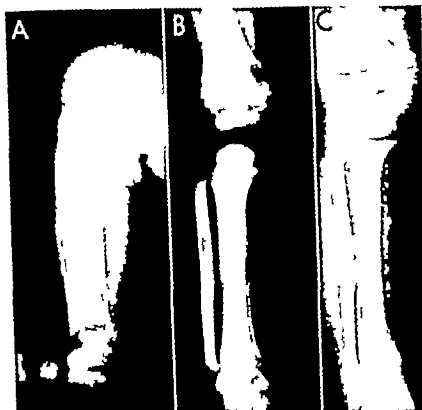


Fig 14—Congenital syphilis in boy aged 8 months. Condition was mistakenly and inexcusably misdiagnosed as scurvy with tragic consequences for patient and great embarrassment for physician. Films show all criteria of syphilis and none of scurvy or rickets. *A* lateral view of right leg *B* frontal view of right leg Total absence of osteoporosis opposes diagnosis of scurvy, total absence of osteoid tissue gap opposes diagnosis of rickets Indicative of syphilis are severe subperiosteal proliferation and breakdown of cortex at distal end of shaft of femur resulting in subluxation of distal epiphysis on shaft Possibility of syphilis was not considered, but because patient was thought to have upper respiratory infection, penicillin was administered with vitamin C. *C* 1 month later marked improvement has occurred, undoubtedly resulting from penicillin rather than from vitamin C (Courtesy of Hodges, P C Postgrad. Med. 24:A55-61 December 1958.)

ally the roentgen findings together with the history leave no doubt as to correct diagnosis

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THE EPIPHYSES

Coxa Plana Its Genetic Aspects and Results of Treatment with Long Taylor Walking Caliper Long Term Fol low up Study of 129 patients 5-26 years after treatment, is presented by R M Wansbrough A W Carrie N F Walker and G Ruckerbauer[5] (Hosp for Sick Children Toronto) There were 105 male and 24 female patients Bilateral disease occurred in 23 Twelve patients had relatives known to have had coxa plana and 7 others had unexamined relatives

(5) J Bone & Joint Surg 41 A 135 146, January 1959

with a limp or hip trouble of unknown etiology From analysis of the sibs born subsequent to 124 probands the frequency of occurrence of coxa plana was found to be 1 in 35 Compared with an incidence in the general population of 1 in 20 000 the difference is highly significant Inheritance based on the present pedigrees was found to be as a sex influenced

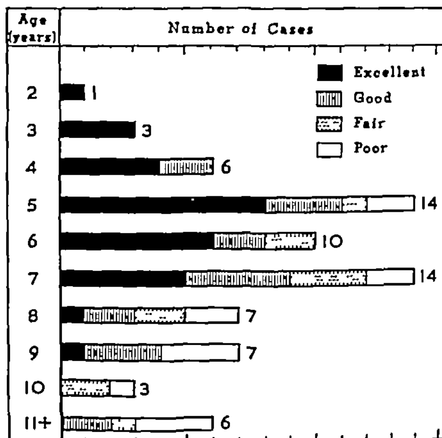


Fig 15 – Effect of age in patients treated in Taylor caliper (Courtesy of Wansbrough, R. M et al J Bone & Joint Surg 41 A 135-146, January 1959)

autosomal dominant with reduced penetrance and varying expression

A Taylor type of caliper with a high shoe on the normal side was used in treatment of most patients For those with unilateral disease the splint was used throughout the course of the disease For those with bilateral involvement it was used after a period of bed rest had allowed one hip to heal sufficiently to bear weight.

Results of treatment with the Taylor walking caliper were classed according to the comprehensive quotient of Heyman

and Herndon and also by the method of Levy and Girard which considers presence or absence of pain, degree of limitation of movement and of shortening of the extremity and deformity of the femoral head In 88% of cases the patients were classed similarly by the two methods Results are shown in Figure 15 which demonstrates the effect of age on outcome Only excellent and good results were obtained in children under age 5, whereas no excellent results were obtained in those over age 10

Ambulation in a long Taylor walking caliper produced results as satisfactory as those reported in children treated by bed rest in splints The ambulatory method permits the child to remain with the parents and to continue social and educational development

Although there is some shortening of the affected extremity at the completion of treatment due to disuse the amount that persists into adult life parallels the deformity of the femoral head In patients who had excellent results with treatment by the Taylor caliper, the average shortening was less than 1/4 in , in those with good results 1/4 1/2 in in those with fair results, about 5/8 in , and in those with poor results, about 3/4 in

Eight patients were treated by sling and crutches These showed an average of about 1 in shortening at the end of treatment. Regeneration of the head and neck of the femur was excellent or good in these patients the shortening taking place in the leg bones In most cases limb length was regained in time

Late Results in Osteochondrosis of Capital Epiphysis of Femur (Legg Calvé Perthes Disease) were studied by Warren G Stamp Gregorio Canales and Richard T Odell[6] (St. Louis) in 132 patients with 146 affected hips The patients were separated into four groups according to the treatment method. Group 1 was treated with traction group 2 with crutch and sling and group 3 with crutch and lift Group 4 was made up of those who received no treatment or inadequate treatment or who were seen so late that treatment could not be expected to reverse the severe deformities already established Those who were seen early but did not cooperate were retained in one of the three specific treatment groups because lack of cooperation represents one of

(6) J.A.M.A. 169:1443-1446 Mar 28, 1959

the hazards of treatment Even after reviewing this series the authors are still uncertain as to the best treatment method for patients seen late in the course of the disease and with severe established deformity

Best results were achieved with bed rest and traction In the groups with satisfactory results the hip was 70% or more of normal the hips in which results were fair varied between 55% and 70% and those in which results were poor were under 55% of normal For 28% of the satisfactory hips the epiphyseal quotient was lower than 70% Of the fair results 25% did not fall within the prescribed range and 10% of the poor exceeded 55% of normal

Perhaps the main advantage of the traction treatment is that the patient is forced to cooperate and the calculated risk in treating this disease with the ambulatory nonweight bearing method is removed Of the inadequately treated group 30% had satisfactory or fair result These were not followed as closely but 40% of them may have had sufficient treatment during the vital period to at least slow down their activity and thus achieve satisfactory or fair result many years later This 30% had no severe metaphyseal changes and passed through the degenerative and regenerative phases much faster than the average Optimum time for full unprotected weight bearing cannot be stated However once regeneration is started increased flattening rarely develops. The authors prefer to see regeneration of the outline of the femoral head before unrestricted weight bearing is allowed in the early regenerative phase lest too early weight bearing lead to increased flattening of the femoral head

► [The treatment of this condition ranges from that of "do nothing" to "absolute bed rest" for a long period. The period of the destructive and regenerative phases of the condition varies with each person and cannot be prognosticated It must be kept in mind that the onset of this condition is at ages 6 to 8 and although ideally the best results may be obtained from absolute bed rest and traction one questions the advisability of this severe a confinement during these formative years when the child is developing both mentally and physically This type of treatment if carried out in a hospital, would be prohibitive under most circumstances and if carried out at home would not only be trying to the parents but perhaps not satisfactory and could present many problems as far as the physician is concerned. It is for that reason that I would question whether the increased percentage of good results of the bed rest and traction treatment as compared with ambulation without weight bearing is justified. Personally, I prefer to treat the child with crutches and a sling provided the condition is not bilateral. In bilateral hip involvement, one is obligated to put the child at bed rest either under traction or in casts Certainly the treatment of this

condition has not been standardized and likewise its etiology not determined. Until the etiology can be determined the exact treatment will of necessity be unknown.—Ed.]

Surgical Treatment of Epiphysiolysis Capitis Femoris in 54 hips of 51 patients is described by Nils Lindström[7] (Inst for Cripples, Härnösand, Sweden). Treatment in 26 hips was by fixation in situ, in 4 hips by closed reduction and in 24 by subcapital wedge osteotomy.

Fixation in situ was performed in patients with up to one third slipping. Sven Johansson's three flanged nail was used in all hips except 1 in which a wing screw was used for fixation. Closed reductions were performed only in patients who clinically and roentgenologically showed acute slipping. Reduction consisted merely in careful inward rotation of the leg. To avoid injury to the blood supply no force was used. In all hips repaired by subcapital wedge osteotomy the three flanged nail was used for fixation except in 1 patient in whom the surgeon was unsuccessful with nailing and the patient was put in a hip plaster.

In the 24 hips nailed in situ follow up was made for an average of 4½ years. In 2 hips secondary arthrosis deformans developed and in 1 changes were present before operation. No caput necroses occurred. All of the patients had more than 90 degrees flexion in the hip joint. One patient was mentally retarded; all others were working. Good clinical and x ray results were achieved in 91.3%.

In the 4 hips with closed reductions follow up was 1.9 years. One patient had caput necrosis. All 4 had 90-degree flexion or more in the hip joint. Three patients were working; 1 was mentally retarded. The patient with caput necrosis worked in an office and had no trouble with the hip apart from a slight limp.

The patients with subcapital wedge osteotomy were followed 1-9 years, 1 of whom had obvious circulatory changes before operation. Follow up showed that 1 had caput necrosis, 1 had traumatic arthritis with narrowed articular space and 1 had secondary deformans changes due to partial caput necrosis. Thus caput necrosis occurred in 14.3% of the hips treated by subcapital wedge osteotomy. All of these patients were working except 1 who was mentally retarded. Flexion ability was 90 degrees or more in 20 hips.

(7) Acta orthop scandinav 25 131 146, 1955

Lindström had no poor results with the three flanged nail and recommends this method of fixation Results of subcapital wedge osteotomy with simultaneous nailing were satisfactory and this treatment is advised in all patients with more than one third slipping

Considerations on Surgical Treatment of Slipped Epiphysis with Special Reference to Nail Fixation. Conservative treatment of slipped epiphysis has been superseded by surgical procedures If the slipping is slight or moderate, bone pegging or fixation in situ with a nail is indicated

Gunnar Wiberg[8] (Univ of Lund) reports results of nailing in 185 patients In 110 a Sven Johansson nail of stainless steel was used Four were treated with a Vitallium nail of essentially the same type and 71 with a Nystrom nail Complications were lower with the Nyström nail than with the blunt three flanged nails The end result was poor in only 1 patient in the entire group In this patient total necrosis of the femoral head occurred In all of the others function was as good as before operation

Complications occurred during surgery in 25 patients but were not followed by aseptic necrosis or disability In 7 of these there was driving away of the epiphysis by the nail in 15 the nail tip pierced the cortex of the femoral head and in 3 a Sven Johans on nail did not follow the guide wire during insertion

Late complications were observed in 23 patients In 2, aseptic necrosis occurred in 1 of whom it was only partial and later healed Loss of grip of the nail in the epiphysis occurred in 17 patients After renailing there was no further slipping in 16 In 4 fracture of the femur occurred at the level of the nail head Each fracture was due to an accident within 1 year of operation The fractures were treated in the usual way and healed in good position without hip-joint complications

Results of bone pegging in treatment of slipped epiphysis are similar to those achieved with the Nystrom nail and are superior to those achieved with the blunt three-flanged nails because of the greater incidence of complications with the three flanged nail The only disadvantage of the bone-pegging method is the relatively long interval before weight bearing is allowed

(8) J Bone & Joint Surg 41 A 253 261 March, 1959

Wedge osteotomy of the femoral neck was performed in 84 hips Partial or total necrosis of the femoral head with poor functional results occurred in 23 (27%) patients Wiberg believes that use of this treatment method for slipped epiphysis is not justified

► [The key to satisfactory results of treatment of the slipped femoral capital epiphysis lies in early recognition of the condition. I much prefer the use of multiple threaded wires for the fixation of the slipped epiphysis rather than a large nail which, by the mere trauma of its insertion, may lead to degenerative changes in the femoral capital epiphysis. Although the wedge osteotomy *is followed by a rather large percentage of cases* showing aseptic necrosis it is sometimes the only method available when the condition has gone unrecognized for a long time. Under these circumstances, it may be the only method available to attempt to restore the hip to normal position.—Ed.]

PARALYTIC DISEASES

Transfer of Tibialis Posterior in Footdrop Deformities is described by A J Selvapandian and Paul W Brand[9] (Vellore India) Any structural equinus varus or other deformity should be dealt with before tendon transfer by corrective plaster lengthening of the tendoachillis or subtalar arthrodesis as indicated When the tibialis posterior tendon is transferred to the dorsum of the foot, it is important to make a direct line of pull and to insert the tendon at the optimum point in the foot so that it produces dorsiflexion without causing an inversion or eversion deformity The path of the tendon must not interfere with the excursion of the tendon during its action Before operation the patient should be given exercises to enable him to distinguish the contraction of the tibialis posterior muscle.

TECHNIC.—An incision is made immediately below the medial malleolus and running forward to the tuberosity of the navicular The tibialis posterior tendon is identified and divided near its insertion. A longitudinal incision is made on the medial side of the leg just behind the tibia, running from about 3 in. to about 6 in. above the malleolus. The tendon of the tibialis posterior is clearly defined then pulled out of the wound. With blunt dissection, all of its attachments to bone or fascia are separated up to the top of the wound and beyond.

If the interosseous space is of adequate width to allow the tendon and part of the muscle to pass freely between the tibia and fibula, and if this is the preferred route, an incision is made 4 in. long on the anterior leg running proximally from about 4 in. above the tip of the medial malleolus. The incision is about ½ in. lateral to the

(9) Indian J Surg 21 151 160 April, 1959

anterior margin of the tibia The plane of cleavage is found between the tibialis anterior and the tibia, and this plane is deepened by blunt dissection by the fingers down to the interosseous membrane. A segment of this membrane is excised from the whole length of the wound.

A curved incision is made on the dorsum of the foot from about the region of the ankle to the base of the 2d metatarsal The skin flap is lifted exposing the tendon of the extensor hallucis and extensor digitorum. The deep fascia between these tendons is incised, exposing the dorsalis pedis vessels These vessels are retracted and the bones deep to them identified. A forceps inserted through the anterior leg incision and through the interosseous membrane is used to grasp the end of the tibialis posterior tendon and pull it through into the anterior

Over all Assessment of Results

	Interosseous Route (25 Patients)	Circumtibial Route (14 Patients)
Range of active movement		
Age		
Over 30	—	36%
30-25	4%	21%
25-20	24%	14%
20-15	32%	29%
15-10	4%	—
Gait		
Normal	44%	79%
Mild high-stepping	52%	21%
High-stepping	4%	—
Over all assessment		
Excellent	20%	36%
Good	48%	57%
Fair	28%	7%
Poor	4%	—

incision. A tunneling forceps is passed from the incision on the foot, deep to the retinaculum to appear in the anterior leg incision. The tendon of the tibialis posterior is passed behind the belly of the tibialis anterior and into the jaws of the forceps. It is then withdrawn into the foot wound.

When the interosseous space is narrow or when the circumtibial route is preferred this method is used a probe or forceps is passed up from the foot incision to join the medial leg incision. No anterior leg incision is needed. The forceps making the tunnel should be kept strictly subcutaneous and should not be allowed to scrape against the bone of the tibia. The end of the tibialis posterior tendon is grasped and drawn down into the foot.

The foot is dorsiflexed and the tendon pulled down to see how far it will comfortably reach. The insertion point of the tendon is chosen carefully so that the action of the tibialis posterior will cause no inversion or eversion. Commonly the insertion point is on the middle cuneiform bone. The tendon is inserted at high tension with the foot in maximum dorsiflexion. To prevent toe-drop the extensor digitorum longus tendons should be pulled on in the foot wound until the toes are level with the foot In this position the tendons are stitched

is steadied the drill is withdrawn and the graft is driven in. The incision is closed and a well fitted spica shoulder cast is applied.

Results in 14 children aged 5-15 operated on are shown in the table. With excellent results the patient was able to abduct the humerus to 90 degrees, to place the involved hand to the hair and to the zipper on the fly of the trousers in the case of a male and to place the arm to the side of the body

TABULATION OF OPERATIVE PATIENTS

	Patient	Age at Fusion	Length of Follow-up	X-ray Fusion?	Clinical Union	Result
(1)	N. H.	5	13	Yes	Yes	Good
(2)	J. S.	6	11	Yes	Yes	Good
(3)	S. R.	7	12	Yes	Yes	Excellent
(4)	J. R.	6	10	Yes	Yes	Excellent
(5)	R. N.	8	5	Yes	Yes	Good
(6)	C. M.	5	5	No	Yes	Good
(7)	D. B.	13	7	?	Yes	Good
(8)	W. S.	5	3	Yes	Yes	Good
(9)	W. B.	5	5	Yes	Yes	Good
(10)	M. C.	15	2	Yes	Yes	Good
(11)	F. S.	9	16	Yes	Yes	Good
(12)	B. F.	7	11	Yes	Yes	Excellent
(13)	C. I.	6	5	Yes	Yes	Excellent
(14)	G. A.	7	9	Yes	Yes	Excellent

without difficulty. With good results the patient was able to abduct the humerus to 45 degrees, to place the hand to the mouth and to the zipper on the fly of the trousers in the case of a male. With both results pain was absent. There were no poor results.

► [This appears to be the most satisfactory method for obtaining arthrodesis of the shoulder without interfering with the growth of the proximal humeral epiphysis. The indications for such an arthrodesis in young children appear much more clear cut in males than in females.—Edward D. Henderson.]

Studies on Disturbance of Longitudinal Bone Growth. II. Effect of Sympathetic Nervous System on Longitudinal Bone Growth after Acute Anterior Poliomyelitis. Frederic J. Kottke, Glenn Gullickson, Jr., and Mildred E. Olson[2] (Univ. of Minnesota) measured the growth rate of the longitudinal bone in the lower extremities in 17 children who had nearly normal strength in one leg and paresis in the other after poliomyelitis. Bone lengths were measured by re-

(2) Arch. Phys. M. 39:770-779, December, 1958.

peated orthoroentgenograms taken over 1.7 years. The effect of long term administration of a sympatholytic drug, a dihydrogenated ergot alkaloid compound, on bone growth was studied in 14 children. The drugs used were dihydroergocornine and Hydergine. Dosage varied from 0.5 mg. 3 times a day to 2 mg. 4 times a day. Reactions were minimal or absent with the dosage used.

Growth of the tibia of the paretic leg occurred only 79.5% as rapidly as growth in the normal leg. Femoral length increased at 91.9% of the normal rate and total extremity length at 82.9% of the normal rate. Treatment with the sympatholytic drug increased tibial growth in the paretic leg to 103.8% of normal, femoral growth to 95.2% and total extremity length to 100.1% of normal.

This study supports the hypothesis that after poliomyelitis there is reflex hyperactivity of the sympathetic nervous system which results in vasoconstriction in the extremity and inhibition of epiphysial bone growth. The most important stimulus for this reflex hyperactivity is cold.

In general, impairment of longitudinal growth is related to the severity of muscular paralysis because the destruction of internuncial neurons, which decreases inhibition of the sympathetic system, usually is similar in degree to the destruction of neurons in the adjacent anterior horns. However, when sympathetic activity was blocked with Hydergine, which has no effect on motor neurons, motor function or the activity of the children, the growth rate of longitudinal bone changed so that it was entirely independent of muscular strength. Discontinuance of medication caused symptoms of sympathetic reflex hyperactivity to cold to reappear and with it the disparity in the growth rates of longitudinal bone in both extremities.

► [The results here published appear startlingly good, with remarkable overgrowth of the short tibia during the periods of therapy. This article certainly should encourage further clinical trials along this line.—Edward D. Henderson]

Prognosis of Limb Inequality Following Paralytic Poliomyelitis was investigated by P. A. Ring[3] in 115 patients studied clinically and radiographically. In many patients measurements were made annually for many years. In most the relative shortening of the more paralyzed leg affected the tibia to a greater extent than the femur, roughly in a pro

(3) Lancet 2:1306-1308, Dec. 20, 1958.

pears to be responsible for the gross depression of epi activity

► [This carefully done study unfortunately fails to add anything efforts to prognosticate the eventual leg length discrepancy from early in the convalescent period.—Edward D Henderson.]

Total Cervical Spine Fusion for Neck Paralysis. Four functional muscle groups control the movements of th and neck. The capital flexors (Fig. 18) and extensor on the skull and motion is centered at the suboccipit

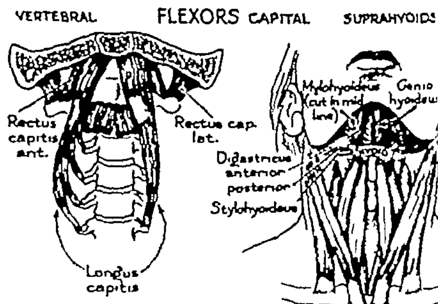


Fig. 18. (Courtesy of Perry, J. and Nickel, V. L.: J. Bone & Joint Surg. 41: 60, January 1959.)

atlantoaxial joints. The cervical flexors (Fig. 19) and tensors act only on the cervical spine with motion cent in the lower cervical spine. The capital extensors are the group because paralysis of these muscles may greatly barrass or completely prevent swallowing and speech.

In severe neck paralysis and instability of the head fus of the cervical spine is the treatment of choice according Jacquelin Perry and Vernon L. Nickel[4] (Downey, Cal The proximal limit of the fusion is dictated by the stren of the capital extensors. When these muscles are weak fus must extend to the occiput for a good result. In presence good capital extensors the proximal extent of the fusion the joint between the 2d and 3d cervical vertebrae. T lower limit of the fusion is determined by the amount of s

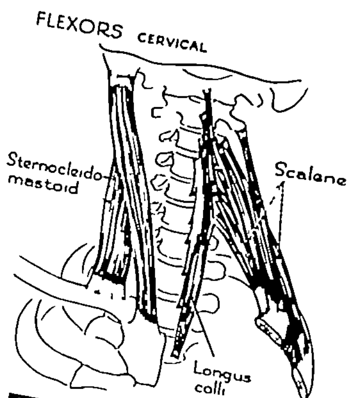


Fig 19 (top)

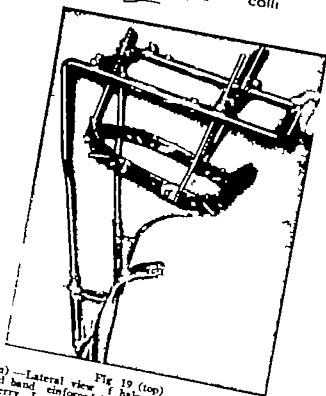


Fig. 20 (bottom).—Lateral view f halo traction device. V-shaped base will be screwed to cast and band einforced by covering with plaster
((Courtesy of Perry J and Nickel, V L. J Bone & Joint Surg. 41 A 37-60 January 1959.)

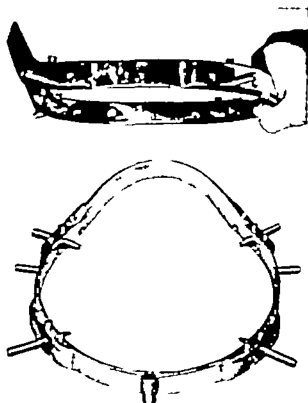


Fig 21 Halo anterior and lateral views. (Courtesy of Perry J., and Nickel, V. L. J Bone & Joint Surg 41 A 37-60 January 1959)

bility of the trunk or scolio is present. When an unstable neck is the only problem the fusion is terminated at the 3d thoracic vertebra to assure good continuity between the fused area and the controlled area of the spine If progressive scoliosis or unstable back coexist the cervical fusion is considered to be a proximal portion of a total spine fusion that may be extended as low as the 4th lumbar vertebra

Of 22 cervical fusions performed by the authors during the past 2½ years 10 included the skull In 12 patients with adequate head stability the proximal limit of the fusions was the axis Wire skeletal fixation was used in the first 2 patients In 1 with simple fusion of the 2d cervical to 3d thoracic vertebrae that required no special positioning a Minerva jacket was used. In all others including all with occipital fusions, immobilization was by a halo traction apparatus (Fig 20) The halo (Fig 21) of this device is fixed to the skull by pins having an offset to prevent excessive penetration The pins



Fig 22.—Halo traction apparatus on patient. Base fastened to cast with screws, but not yet covered with plaster (Courtesy of Perry J., and Nickel, V J Bone & Joint Surg. 41 A:37-60 January 1959)



Fig. 23—Patient's position at surgery Note support under halo. (Courtesy of Perry J., and Nickel, V L.: J Bone & Joint Surg. 41 A 37-60, January 1959)

are easily applied by simple screwing without initial incision and can be changed easily under local anesthesia. The halo is fastened to an adjustable countertraction device that is fixed to the body cast (Fig 22) By this means controlled traction and adjustment in all directions are provided

The postoperative course was uneventful after cervical fusion in the present group probably because of the liberal use of respiratory aid during the postoperative period, judicious replacement of blood lost during surgery and the protection offered by the halo traction during surgery (Fig 23)

► [Adequate length of fusion for deformity of the paralytic spine is here carried to its logical end point. The use of the halo fixation appears to be effective and comfortable for the patient.—Edward D Henderson]

Correction of Equinus Deformity in Cerebral Palsy Henry H Banks and William T Green[5] (Boston) evaluated results of surgery for equinus deformity in 132 patients with

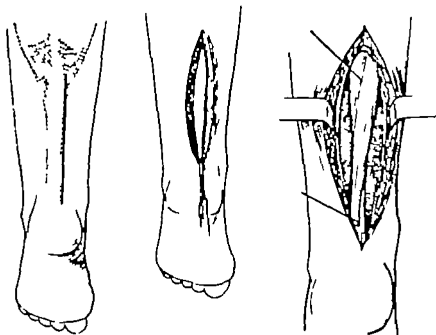


Fig 24.—Skin incision is medial in position. Incision of subcutaneous tissues is carried directly through tendon sheath so sheath can be reconstructed effectively. Rotation of fibers is carefully identified so one-half can be divided above and one half below (Courtesy of Banks, H. H., and Green W T J Bone & Joint Surg 40-A 1359 1379 December 1958.)

cerebral palsy In 112 patients 164 heel-cord lengthenings were performed The procedure most commonly used was of the sliding type which takes advantage of the rotation of the fibers of the Achilles tendon The fibers which occupy a medial position above twist laterally as they approach the calcaneus so that they are then posterior to the fibers that originally occupied the lateral position (Fig 24) A transverse

(5) J Bone & Joint Surg 40-A 1359-1379 December 1958.

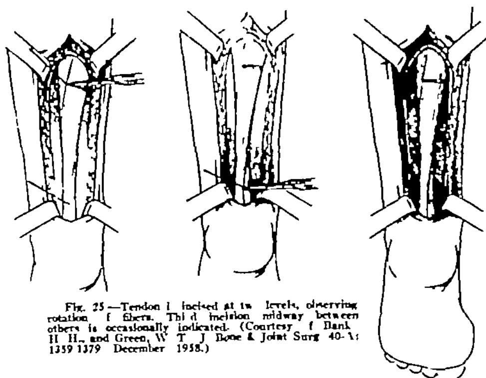


Fig. 25.—Tendon is incised at two levels, observing rotation of fibers. Third incision midway between others is occasionally indicated. (Courtesy of Banks, H. H., and Green, W. T.: J. Bone & Joint Surg. 40-A: 1359-1379, December 1958.)

division is made of about half of these fibers in the proximal portion of the surgical wound and the other half in the distal portion (Fig. 25). The foot is then dorsiflexed strongly with the knee in extension (Fig. 26). A sliding of the medial fibers on the lateral fibers of the Achilles tendon then occurs, resulting in actual lengthening of the tendon. The sheath of the tendon is sutured over the newly lengthened Achilles tendon, the wound is closed and the limb is immobilized in a toe-to-groin cast with the knee extended and the foot at 90 degrees of dorsiflexion (Fig. 27). Adequate postoperative management is essential to obtain a good result. Long term support out of the equinus position at night during the growing period and an exercise regimen to develop balanced muscle function are essential.

Of the 164 heel-cord lengthenings performed, results in 22 were excellent, in 92 good, in 34 fair and in 14 poor. Nearly 50% of the poor results were in patients with type 4 motor status, whereas 65% of the good and excellent results were in patients with type 1 or 2 motor status.

In 10 patients the operation of choice for correction of

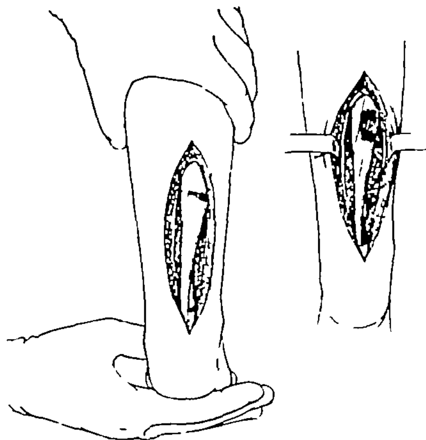


Fig 26.—Passive dorsiflexion results in sliding lengthening with continuity of heel cord so firm that sutures seldom are used. (Courtesy of Banks, H H and Green W T: J Bone & Joint Surg 40-A:1359-1379 December 1958.)

equinus deformity on 19 occasions was a fractional lengthening of the gastrocnemius origin (Figs 28 and 29) All but 3 procedures were done in combination with hamstring lengthening in which this was the primary procedure The usual indication for this type of surgery was pronounced knee-flexion deformity Results in 8 operations were good in 7 fair and in 4 poor

A Stoeffel neurectomy alone was performed 3 times 1 result was excellent and 2 were poor Of 14 neurectomies performed in association with fractional lengthening of the gastrocnemius origin results in 4 were good in 6 fair and in 4 poor

In 20 patients triple arthrodesis was performed on 24 occasions Five arthrodeses were performed in presence of equinus without other deformities Results were good in 2

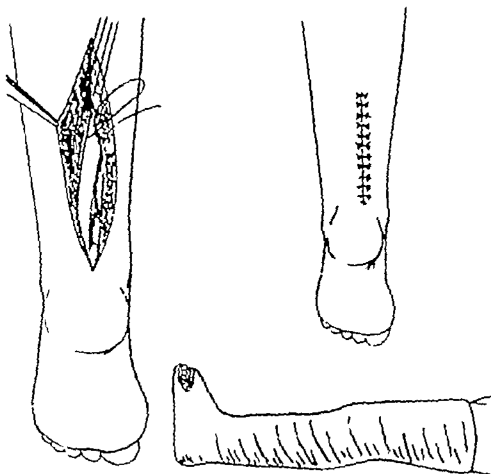


Fig. 27 —Sheath must be closed over lengthened tendon. Limb immobilized with toe-to-groin cast with knee in extension and foot in neutral dorsiflexion. (Courtesy of Banks, H. H., and Green W T J Bone & Joint Surg 40-A:1359 1379 December 1958)

and fair in 3 Moderate equinus deformity associated with severe varus valgus or cavus deformity was present preoperatively in 19 patients Results were excellent in 1 good in 8 fair in 4 and poor in 6

Orthopedic procedures for correction of equinus deformity in patients with spastic cerebral palsy are effective when surgery is adequately performed on properly selected patients and is followed by careful postoperative management The authors choice of technic for correction of equinus deformity is the sliding lengthening of the heel cord. If there is instability at the subtalar joint and associated deformity of the foot such as a disturbing valgus or varus deformity arthrodesis should be done at the appropriate time Combined

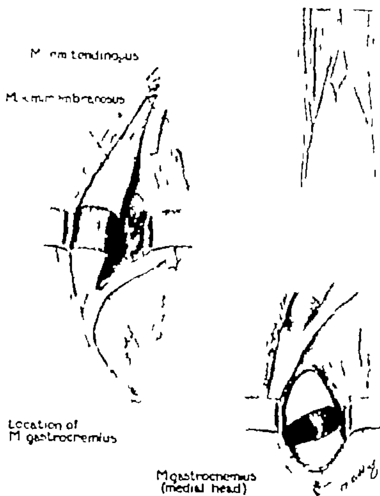


Fig 28 Fractional lengthening of gastrocnemius performed as secondary procedure with hamstring lengthening for knee flexion and equinus deformity (Courtesy of Banks, H H, and Green, W T J Bone & Joint Surg 40-A 1359-1379 December 1958.)

heel cord lengthening and subtalar extra articular arthrodesis after age 5 will correct a valgus deformity give a stable foot and may avoid the necessity of triple arthrodesis at a later age Severe equinus deformity should not be corrected by triple arthrodesis alone because too much bone must be removed which would result in a foot with markedly diminished height

► [It is difficult to assess the results in such a study since the effectiveness of one or a combination of these operative procedures depends to a great extent on the preoperative evaluation by the surgeon and his care and experience in selecting the proper procedure to be used —Edward D Henderson]

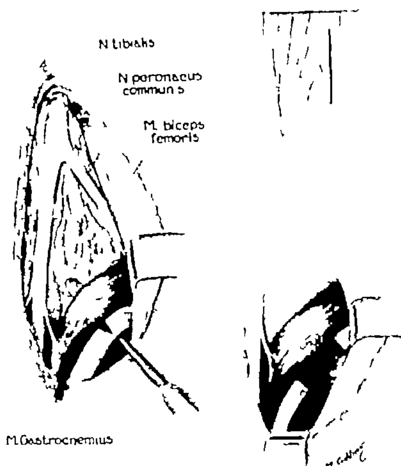


Fig 29—Tendinous portion of medial and lateral heads of gastrocnemius are sectioned. Neurectomy of nerve supply to one head of gastrocnemius was performed at same time in all but five. (Courtesy of Banks, H. H. and Green, W T; J Bone & Joint Surg 40-A 1359 1379 December 1958)

Gastrocnemius Muscle Recession (Silfverskiold Operation) for Spastic Equinus Deformity in Cerebral Palsy was performed by Caroll M Silver and Stanley D Simon[6] (Providence R. I) in 110 patients between 1947 and 1958 with recurrence of equinus deformity in 5 The role of orthopedic surgery in treatment of deformities of the lower extremities is primarily that of helping the patient to attain the ability to walk independently and secondarily to improve the gait and prevent development of increasing deformities in patients who have failed to respond to conservative therapy

(6) J Bone & Joint Surg 41 A 1021 1028, September 1959

Spastic equinus contracture is the commonest deformity of the lower extremity in cerebral palsy children Silfverskiold divided spastic equinus contracture into two groups one of which is passively correctable by knee flexion to a right angle The gastrocnemius function is the primary deforming factor in this group and is the most commonly encountered in children The Silfverskiold operation consisting of gastrocnemius muscle recession with partial neurectomy is an effective reliable procedure for spastic equinus deformity when proper indications are present

An accurate graded evaluation of the result of an operative

Spastic Equinus Deformity Treated by Gastrocnemius Recession Operation

Age of Operation	No of Operations	Postoperative Follow-up Period 0 to 2 yrs.	2 to 5 yrs.	5 yrs+
10 mos	1			1
2 yrs.	5	2	2	1
2½ yrs	2	2		
3 yrs.	15	3	2	8
3½ yrs	7	2		5
4 yrs.	22	5	8	9
5 yrs	11	4	6	4
6 yrs.	23	6	10	9
7 yrs.	6	1	2	3
8 yrs.	5	1	4	
9 yrs	3	2		1
10 yrs	1			1
11 yrs	0			
12 yrs	0			
13 yrs	1	2		2
	110	32	31	41

procedure for spastic equinus deformity cannot be made other than to determine whether the equinus deformity has remained corrected or has recurred In children with cerebral palsy many factors that cannot be dissociated from the foot and leg mechanism play an integral role in determining the results of a surgical procedure These factors include hip contractures strength or weakness of the pelvifemoral and trunk muscles involvement and coordination of the upper extremities intelligence and balancing reflex. In 89 of the operations performed by the authors there was also release of hip adductors performed at the same operative session

Given well-defined spastic deformities of the lower extremities the earlier the age at which definitive surgery is

undertaken the better to prevent disabling secondary contractures of joint capsules and neurovascular structures. Early surgery eliminates the physiologic overstimulation of the reflex pathways from the calf muscle group and decreases the overflow into other limb and trunk muscles.

On the basis of the age at which developmental progress and abnormal neuromotor patterns are fairly well established, the optimal age for operation is about 3 years. Only 23 of the operations were performed in patients aged 3 or under.

Average age at operation was 5 years, with a range of 19 months to 13 years (table).

► [This operation has proved quite effective in our hands in the case with concomitant weight bearing knee flexion deformity and equinus deformity at the ankle.—Edward D. Henderson.]

Subluxation of Shoulder in Hemiplegic Patients. Osvaldo Mighetta, Alexander Lewitan and Joseph B. Rogoff[7] studied 20 men and 30 women chosen at random from the hemiplegic population of the Jewish Chronic Disease Hospital, Brooklyn, clinically and radiologically for presence or absence of subluxation of the shoulder on the involved side. This was done with the patient sitting or standing. Subluxation is readily verified by the altered anatomic profile of the involved shoulder and the presence of a groove below the acromion on the outer aspect. This groove is often visible and always easily palpable.

Positive clinical findings of subluxation of the shoulder on the involved side were found in 28 (56%) of the patients. By x rays, subluxation varied from a few millimeters to almost complete subluxation, with the humerus observed below the glenoid fossa. In most patients, however, the subluxation was only about 1 cm. To evaluate this finding more closely, injection of the shoulder joint followed by x rays in erect and supine projections were done.

In most instances the injected joints showed striking increase of fluid in the superior portions, which would indicate that the capsule had been stretched. Occasionally a tear was also demonstrated, with abnormal communication of the shoulder joint and the subacromial bursa.

Neither the patient's age, duration of the hemiplegia nor spasticity had any relation to the presence or absence of sub

(7) New York J. Med. 59:457-460, Feb. 1, 1959.

luxation A certain relationship did exist however between subluxation and active shoulder range of motion

Electromyography studies were obtained in 6 patients with pronounced subluxation and revealed electric silence when the shoulder muscles were at rest This indicates that this was not a true flaccid paralysis caused by a secondary lower motor neuron lesion after traction on the brachial plexus or the 5th and 6th spinal nerve roots

Electric stimulation of the muscles of the shoulder girdle was attempted but the success of this method is doubtful

► [A reminder that inferior subluxation of the shoulder with pain is a frequent complication of hemiplegia and can be prevented by the use of an adequate sling —Edward D Henderson.]

Coordinative Orthopedic Surgery for Hemiplegic Patient is described by Milton C Cobey[8] (Georgetown Univ) Operative procedures aimed at the muscles or tendons have proved useless There is no point in lengthening tendons that will continue to foreshorten by contracture

The Stoffel operation has been used in congenital spastic paralysis for many years The operation has been most successful when done in those spastic patients who needed it to relieve overactive muscle pulls against weak antagonistic muscle groups The operation can be done under local anesthesia in adult older age patients

The Stoffel operation is most useful in the upper extremity The surgeon approaches the median nerve in the antecubital fossa Under local anesthesia the nerve is not difficult to find The nerve branches are identified and avulsed from the muscle bellies with careful dissection along the nerve to find those that enter into the muscle involved in producing the deforming contracture The most commonly involved muscles are the flexor carpi radialis flexor carpi ulnaris and flexor sublimis and profundus The number of nerve branches to the muscles to be removed must be determined. Only sufficient function is destroyed to allow the antagonistic groups of muscles to pull the member into proper position of function again

Cobey performed the operation in a number of hemiplegics in an effort to restore for them good function of the extremities and a more normal life

When the operation is performed on the foot by removing

(8) M Ann District of Columbia 28 259-261 May 1959

the branches to the gastrocnemius soleus muscle groups the dorsiflexors of the foot again take over The patient can dorsiflex the foot There is still sufficient power so that the patient can walk with an almost normal gait He can come forward on the forefoot with the pull of the gastrocnemius and soleus The heel will strike the ground comfortably

In male patients who refuse surgery, a brace may be necessary, which should be nonapparent and should aid in walking Patients who have footdrop because of overaction of the gastrocnemius soleus muscle group and have refused surgery may gain some support from the brace Their balance of power is not correct, and a disappearing type of foot brace has been designed for them Cobey first designed this brace for male patients with anterior poliomyelitis who had stable ankles and needed a short leg brace to prevent foot drop This was named the nonapparent foot brace

► [The emphasis on localized or regional neurectomy in spastic hemiplegia seems warranted in view of the historic preponderance of papers and procedures to lengthen tendons and muscles and perform arthrodesis. A balance has been and is needed.—Edward D Henderson.]

Decubitus Ulcers among Spinal Cord Injury Patients Sacral Area and/or Coccygeal Ulcer Management. A Estin Comarr[9] describes the wire button retention technic used in the surgical treatment of sacral and coccygeal decubitus ulcers

TECHNIC.—An elliptic incision (Fig 30) is used in most cases. The S- or Y shaped incision is used where indicated An irregularly V shaped ulcer is more suited for the Y incision (Figs. 31 and 32) Once the ulcer and its lining have been excised, bony prominences are removed with a chisel and/or rongeur Usually removal of a thin layer of the outer table of the sacrum is sufficient. Bone that is smooth and uninvolved need not be resected

The skin is then undermined by scissors or a knife between the subcutaneous tissue and muscle or fascia until the wound edges can be pushed together by hand pressure without excessive tension Bleeding from soft tissue and bone is controlled exclusively by electrofulguration. Wire button retention sutures are then introduced using stainless steel 26-28 gauge wire These sutures include only the undermined flap of skin and subcutaneous tissue no attempt is made to include fascia or muscle. Adequate drainage is accomplished by Penrose drains introduced by puncture wounds or at either end of the closure.

The skin edges are closed with interrupted mattress-on-edge sutures, using 30-32 gauge stainless steel wire. A compression dressing is applied. The dressing is changed after 7 10 days and the drains are

(9) J Indian M Prof. 5:2464-2467 December 1958.

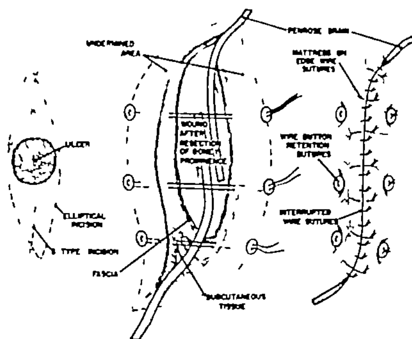


Fig 30 —Closure of decubitus ulcer by wire-button technic. (Courtesy of Comarr A E. J Indian M Prof 5 2464-2467 December 1958.)



Fig. 31 (left) Irregularly Y shaped sacral decubitus ulcer
Fig 32 (right) —Healed scar after Y closure
(Courtesy of Comarr A E. J Indian M Prof 5 2464-2467 December 1958.)

shortened. By the end of 2 weeks all drains and sutures are removed, and then the patient is permitted to stand with the aid of braces, stall bars or a tilt table

If the ulcer is sacrococcygeal coccygectomy is performed The distal end of the sacrum is usually resected for 1 2 cm

Of 1,389 patients treated at the VA Spinal Cord Injury Center Long Beach Calif 157 (11%) required surgical closure of sacral ulcers Cure rate has been about 93% Failures have been due to occasional hematoma formation or wound dehiscence with secondary infection Wound dehiscence usually results from attempt to close a defect that is too large

► [The care in planning and handling local skin flaps with the adequate use of tension sutures to avoid tension at the skin suture line makes the closure of decubiti a much more gratifying procedure —Edward D Henderson.]

INFECTIOUS BONE DISEASES

Prevention and Treatment of Infections in Bone According to John H Moe[1] (Univ of Minnesota) excessive operating time in operative open reduction of fractures invites infection Plates and screws without external fixation provide inadequate internal fixation in comminuted fractures of the long bones and especially of the femur Wound infections in open fracture surgery should not be treated expectantly The surgical principles of complete exposure of the infected area eradication of the grossly necrotic tissue removal of all plates and screws and open packing of the wound for easy dependent drainage are sound. Maintaining the position of the fracture fragments and the institution of specific antibiotic medication locally and systemically are also of importance The optimum time for secondary closure is about 5-10 days If the initial debridement is adequate and if the wound is kept widely open and packed it will usually be clean and free from pocketed purulent material at that time.

When secondary closure is done the wound must be completely obliterated of dead space Avascular scar tissue must be excised and live muscle or flaps of skin and subcutaneous tissue must be used to eliminate such dead spaces Intramedullary nail fixation can be instituted in the presence of infection without hazard

When bone sequestrates the necrotic portion must be removed. Bone healing and regeneration will occur in presence of infection of the fracture if properly handled

The prevention of infection in compound fracture wounds

(1) Journal-Lancet 79 2 January 1959

is directly related to the initial care given the wound. By proper decontamination of the wound all fresh compound fractures should theoretically heal per primam. It is of great importance to recall that fresh compound wounds are *merely contaminated with dirt and bacteria that can be removed by mechanical cleansing*. After 8 or more hours have elapsed it may be assumed that the bacteria have begun to multiply and invade the tissues and that mechanical cleansing will not remove them.

During the initial decontamination of the wound these procedures are important: removal of hair from the wound margins by a sterile razor; excision of devitalized skin margins as necessary; opening of the wound by extending the incision so that the entire fracture site becomes accessible; no removal of large bone fragments even if a fragment is free; and thorough decontamination and replacement of all bone fragments.

[► This article is timely. It calls attention to the basic surgical principles for the treatment of infections not only in bone but in any wound. Unfortunately the advent of the antibiotics lulled the medical profession into a false sense of security, but now with the advent of antibiotic resistant organisms we are forced to revert to sound surgical principles of infection treatment whether it be in bone or soft tissue. Every precaution must be taken to prevent infection of a clean surgical wound and every surgical method known should be used in eradicating already established infections by proper drainage, debridement and the use of proper antibiotics. Certainly the unnecessary use of antibiotics is to be avoided and its routine postoperative use is not indicated. Proper means of caring for infected patients should be instituted by seeing that all laundry that comes in contact with the patient is properly sterilized and instruments used in caring for and serving the patient that is infected should be kept from contact with other patients before sterilization. Strict isolation technic should be maintained for all infected cases on any operating floor and dressings on such cases should not be done without proper protection of the personnel in order to prevent carrying the infection to other patients. It is important that traffic through operating room corridors be kept at a minimum and preferably limited to those who are properly clothed for direct entrance into an operating room. Every hospital should have a functioning committee to receive reports of infections so that the personnel may be acquainted with the source of infections and proper methods taken to prevent them. —Ed.]

New Treatment for Osteomyelitis: Extremity Perfusion with Antibiotics is described by Robert F. Ryan, J. N. Winblad, R. K. Hayes, W. N. York, G. Hottinger and Keith Reemtsma[2] (New Orleans). Most of the causative organisms in chronic osteomyelitis are resistant to the commonly used antibiotics. If the bacteria are sensitive only to antibi

(2) J. Louisiana M. Soc. 111: 113-115, April 1959.

otics that produce systemic toxicity such treatment must be modified or withheld Yet this systemic toxicity can be avoided or minimized by use of the isolation perfusion technic The authors carried out animal experiments to determine the maximum amount of various antibiotics possessing systemic toxicity that could be administered by the isolation perfusion technic. The hind limb of a dog was used for determination of the safe dosage level of antibiotic agents administered by the isolation perfusion technic A simple bubble dispersion oxygenator and a sigmamotor pump were used for the extracorporeal circuit Bacitracin and chloramphenicol were the first drugs studied

The procedure involved cannulation of the common femo-

RESULTS—CONTROL PERFUSION

Bacitracin Dosage Units/Kg. Body Weight	No. Treated	Survived
4,000 Control	6	2
2,000 Perfusion	3	3
4,000 Perfusion	10	8
Chloramphenicol Dosage (Gm./Kg. Body Weight)		
0.5 1.0 Perfusion	3	0
0.25 Perfusion	7	4
0.1 Perfusion	10	8*

*Two dogs died of unrelated causes.

ral artery and vein after which perfusion was carried out for 30 minutes At completion of the perfusion the limb was washed out with 200 cc drug free perfusate. Increasing amounts of bacitracin were used until the maximum safe dosage was determined Because the dog kidney is more resistant to the deleterious effects of bacitracin than is the kidney of other animals all receiving 4 000 units/kg body weight were subjected to unilateral nephrectomy before perfusion of the leg The control animals were given the same amount of bacitracin by direct intra arterial injection

Results are summarized in the table because about 25% of the animals receiving 4 000 units/kg body weight failed to survive 3 000-3,500 units/kg was selected as the maximum safe dosage of bacitracin in the hind limb of a dog by the technic described In determining a safe dosage level for chloramphenicol massive dosage was used initially then decreasing amounts were administered until a safe level was found

The authors used this method successfully for administra-

tion of massive doses of bacitracin and chloramphenicol in a man, aged 37 with chronic osteomyelitis

► [*This new method of treatment sounds most intriguing and obviously relates to the perfusion method for treating malignancies limited to one extremity This perfusion method may produce striking results and it development should be watched closely in the future.* Granted, the present report is based mainly on animal experimentation but it is interesting to note that at least one patient has already been treated by this method —Ed]

Coccidioidal Villous Synovitis Report of Case and Consideration of Literature Walter A Haug and Rolland C. Merrifield[3] (VA Hosp Portland Ore) observed villous



Fig 33 Coccidioidal synovitis of knee. (Courtesy of Haug W A and Merrifield, R. C Am. J Clin Path 31 165 171 February 1959)

synovitis of the knee in which the etiologic agent Coccidioides immitis was identified morphologically and mycologically

Man 35 was hospitalized for incision and drainage of a left peritonsillar abscess. He had had spontaneous intermittent pain swelling and tenderness in the right knee and ankle for 2½ years. There was swelling tenderness and limitation of motion of the right knee and ankle. The right tibia revealed a radiolucent lytic lesion in the lateral condyle and another in the proximal end of the right 1st metatarsal bone, with destruction of the tarsal metatarsal joint and the distal end of the 1st cuneiform bone. Two skeletal surveys were not otherwise remarkable.

Synovectomy and medial and lateral meniscectomy were performed. The resected tissue had the general appearance of a severe villonodular synovitis (Fig 33) The villous or papillary projections were numerous large and small varying in length from 0.5 to about

(3) Am J Clin. Path. 31 165 171 February 1959

3 cm. with a thickness of 3-15 mm They were yellow red with pale gray tips At the base of the villi the tissue was firm and nodular the latter measured up to 2.5 cm in thickness

Microscopic examination revealed typical solitary tubercles dispersed in a stroma of chronic inflammatory and granulation tissue. The appearance was that of tuberculosis except that the characteristic spherules of C immitis were observed within the Langhans giant cells and occasionally in the inflammatory tissue (Fig 34) These



Fig. 34—Spherule of Coccidioides immitis in lesion of synovial tissue. Hematoxylin-eosin reduced from ×570. (Courtesy of H ug W A. and Merrifield, R. C. Am. J Clin. Path. 31 165 171 February 1959)

spherules were readily evident with PAS The villi manifested increased vascularity and contained many plasma cells and a few granulocytes and lymphocytes. They were often covered by a single row of synovial cells but some villi were capped with fibrin and actually lined with fibrinous material. Still others revealed erosion of the tips and replacement by granulation tissue. In the deeper nodular component, connective tissue proliferation was evident, and only minimal chronic inflammation was present.

Pus drained from both incisions on the knee, and a cast was applied. Drainage subsided almost completely in about 3 months and the cast was removed. In about 2 weeks the knee became swollen and tender again and began to drain profusely Drainage continued intermittently for about 2 more months.

The manner of spread to the joints and synovia in this patient seems to be extension from the osseous lesions. The latter undoubtedly arose via the blood stream from some focus elsewhere ,,

ably the lung or hilar lymph nodes. Further lesions will probably develop elsewhere. The disease is more than likely of the disseminated type

Bone Involvement with Disseminated Histoplasmosis. Joseph H Allen, Jr[4] (Vanderbilt Univ) reports 2 cases.

CASE 1 —Boy aged 3 months was hospitalized because of abdominal enlargement and failure to gain weight. X ray examination of the abdomen revealed moderate hepatomegaly and marked splenomegaly (Fig 35) The long bones (Fig 36) showed moderate cortical



Fig 35 – Abdominal film showing moderate hepatomegaly and marked splenomegaly Incidental findings of rib and vertebral anomalies are present. (Courtesy of Allen, J H, Jr Am J Roentgenol 82 250-254 August, 1959)

thickening that appeared to be subperiosteal on all the shafts osteoporosis and questionable irregular widening of the medullary canals. Histoplasmin and OT skin tests were negative but histoplasmin complement fixation was positive. The patient s condition deteriorated steadily with progressive evidence of bone marrow depression. He died 2 weeks after admission At autopsy Histoplasma capsulatum was found free in giant cells and in granulomas in virtually every tissue of the body Massive bone marrow invasion was pres-

(4) Am J Roentgenol 82 250 254 August, 1959

ent, and there was marked extramedullary hemopoiesis. No cortical bone specimens were examined.

CASE 2.—Boy aged 9 months had been sick all his life. He weighed only 10 lb. The liver was moderately and the spleen greatly enlarged. White blood cell count was 4,400, hemoglobin 3.8 Gm. and platelets 10,000. Histoplasmin and OT skin tests and the initial histoplasmin complement fixation test were negative. Bone marrow smear and several bone marrow cultures revealed histoplasma and the complement fixation test subsequently became positive. X rays of the skull showed patchy frontal and parietal destruction. External cortical thickening, osteoporosis and multiple foci of rarefaction were seen throughout the long bone shafts and in the epiphyses and bones of the hands and feet. The scapulae, clavicles and pelvis were involved but the ribs and vertebrae showed no abnormality except cortical



Fig. 26. Extremities show cortical thickening along bone shafts, osteoporosis and questionable irregular widening of medullary canals. Skull examination was not remarkable. (Courtesy of Allen, J. H., Jr.: Am. J. Roentgenol. 82:250-254, August, 1959.)

thickening. Bone biopsy showed several small foci of granuloma formation and hyalinization within the periosteum. Disorganization of the cellular architecture was noted, and small spherical bodies were seen, which were shown to be H. capsulatum. The patient is being treated with triple sulfonamides and amphotericin B and has shown gradual improvement.

The x ray findings in Case 2 are well correlated with those in a case of primary bone involvement reported by Klingberg. The findings appear to have real diagnostic value. Case 1 apparently represented a milder form of bone involvement.

Brucellosis Myelopathy Walter Ganado and Alfred John Craig[5] (Valletta Malta) point out that a small percentage of patients with brucellosis experience extradural cord compression from spondylitis Of 6,300 patients with brucellosis 130 were known to have brucellosis spondylitis. Of these 130 10 manifested signs of compression myelopathy

The characteristic tissue reaction to invasion by brucella is granulomatous. In man the granulomas are small which accounts for the failure of x rays to show bone changes in the common cases of brucellosis Vertebrae and joints that appear unaffected in x rays may nevertheless be the seat of lesions

As in tuberculosis the granulomatous and other changes provoked by brucella in the spine aggregate initially on subchondral bone tissue When these tissues are eroded and destruction of the cartilaginous plate in two adjacent vertebrae occurs the intervertebral disk loses its turgescence and can no longer keep the vertebral bodies in proper separation Osteophyte formation in brucellosis spondylitis is remarkably rapid The osteophytes form on each side of the affected intervertebral joints and tend to ankylose by bridge formation

Brucella in bone are apt to provoke suppuration with formation of a cold abscess Eroded vertebral bodies may collapse as in tuberculosis Wedging of vertebrae angulation and tilting to a side are not uncommon Brucella may produce cord compression in the same way Seddon described for type I Pott s paralysis The authors emphasize that diagnosis of brucellosis meningomyelitis should not be made unless brucellosis myelopathy from compression has been carefully excluded Early recognition of compression myelopathy is important because prognosis can be good when rest and appropriate antibiotics are given in time

Treatment of Tuberculosis of Bone and Joint is described by David M Bosworth[6] At present only iproniazid is used internally in the treatment of bone and joint tuberculosis at the Sea View and St Luke s hospitals New York During the 1st year that this drug was available a dosage of 4 mg/kg/day was maintained. When this dosage was given for more than 6 weeks psychoses developed in about 10% of

(5) J Bone & Joint Surg 40-A 1350-1388, December 1958
(6) Bull. New York Acad. Med. 35 167 177 March, 1959

the patients At present, when severe disease exists a patient is placed on 4 mg/kg/day for 2-4 days which then is reduced to 2 mg/kg/day Occasionally, medication must be discontinued for a few days, then restarted At this level of dosage personality changes aside from mild euphoria are rarely noted and no psychoses have developed Hepatitis as a toxic manifestation has not been observed On the basis of clinical evaluation (which cannot be satisfactorily supported statistically) iproniazid is 21 times as effective as isoniazid in treatment of bone and joint tuberculosis In soft tissue lesions of the tendon sheath and fascia etc. Bosworth believes that treatment for 6 months to 1 year after healing and subsidence of all inflammatory reaction is sufficient In osseous lesions 2 3 years of medication as a minimum is required

The greatest indication for surgery in the tuberculous joint is for early and positive biopsy Every tuberculous lesion of the spine needs a stabilizing spine fusion despite the fact that in some of them the diseased process probably could be arrested by iproniazid During or after arrest of the disease further collapse of the involved bodies will occur This can be prevented to a great extent by adequate spinal fusion

In the adult arthrodesis should be done in any weight bearing joint that has been so badly destroyed by disease that salvage with function has been compromised In children arthrodesis of badly destroyed weight bearing joints may have to be done However, delay in decision is justified when the patient is on iproniazid therapy until demonstration of functional deformation or satisfactory result becomes evident. In children certain weight bearing joints with gross bony defects particularly the knee may heal to a remarkable extent with iproniazid therapy

Central Graft Operation for Fusion of Tuberculous Knees Ankles and Elbows according to George W Van Gorder and Chien Min Chen[7] (Lakeville State Sanatorium Middleboro Mass) is especially applicable to children because central grafts do not arrest bone growth while they are stimulating bone union (Fig 37)

In single central graft for knee fusion the Coonse Adams approach is used (Fig 38) with a pneumatic tourniquet applied to the thigh and the knee joint is exposed followed

(7) J Bone & Joint Surg 41 A 1029 1046, September 1959

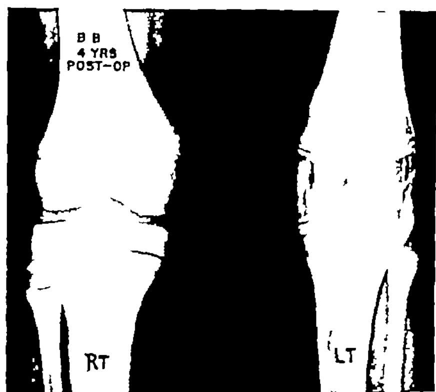


Fig 37 Tuberculosis of left knee 4 years after central graft operation for fusion. Epiphyseal lines are open and appear same as on knee not operated on. When patient was age 15 there was shortening of ½ in. (Courtesy of Van Gorder, G. W., and Chen, C. M.: J. Bone & Joint Surg. 41-A: 1029-1046, September 1959.)

by erasion of the articular cartilage and excision of any diseased synovial membrane. An autogenous bone graft is removed from the anterior surface of the upper end of the tibia or the lower end of the femur keeping 1 inch away from the adjacent epiphysial line. Whether the tibia or the femur is selected for the donor site depends on the location of the disease. Solid bone fusion by this operation was obtained in 15 children with tuberculosis of the knee. The commonest complication associated with this operation in children was the occurrence of genu recurvatum. In the fusion of tuberculous knee joints in children it is of extreme importance to avoid allowing the patella from becoming attached to the femur at the anterior epiphysial line. In the authors series this occurrence produced local cessation of growth with resulting pronounced genu recurvatum and shortening.

The single central graft fusion operation for tuberculosis of the knee was successful in all of the 9 adults operated on

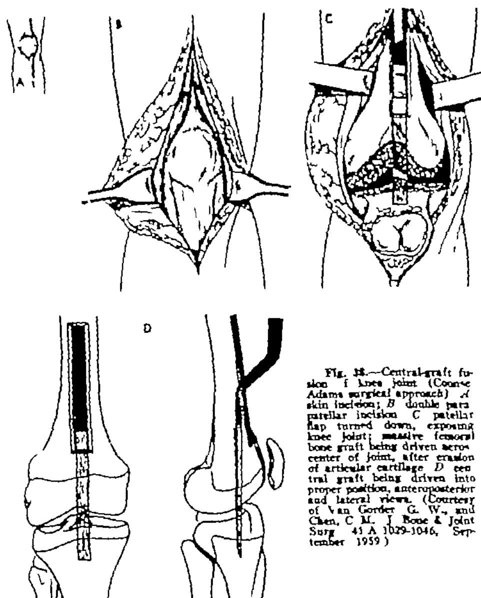


Fig. 38.—Central-graft fusion of knee joint (Coonse Adams surgical approach) *A* skin incision; *B* double para patellar incision *C* patellar flap turned down, exposing knee joint; massive femoral bone graft being driven across center of joint, after erasion of articular cartilage *D* central graft being driven into proper position, anteroposterior and lateral views. (Courtesy of Van Gorder G. W., and Chen, C M. J Bone & Joint Surg 41 A 1029-1046, September 1959)

though 1 required a second operation Of the 10 adults who had the more conservative dual central graft operation for tuberculous knees (Fig 39) successful fusion occurred in 8 and failure in 2.

In treatment of tuberculosis of the ankle the central-graft fusion operation (Fig 40) was performed in 4 children and 5 adults Fusion was obtained in all and there were no failures This success was obtained without opening up of the diseased joints or erasion of the joint cartilages

Fig 39 —Central-dual graft fusion f knee joint A kl incisions; *B* bone tunnels made for bon grafts with H tt bayonet osteotomes; *C* and *D* bone grafts being driven into place with Hatt bayonet drivers, anteroposterior and lateral views. (Courtesy of Van Gorder G W and Chen C M J Bone & Joint Surg 41 A 1029-1046, September 1959)

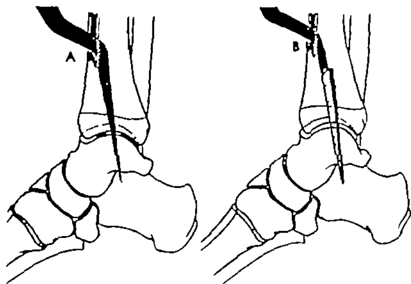


Fig 40 —Central-graft fusion of ankle and subtalar joints *A*, creation of bone tunnel for central bone graft, *B* graft being driven nto place (Courtesy of Van Gorder G W., and Chen, C M J Bone & Joint Surg. 41 A 1029-1046 September 1959)

In tuberculosis of the elbow (Fig 41) the operation was not as successful as among the patients with disease of the knee and ankle. Six patients with tuberculosis of the elbow were operated on and, though fusion was obtained in 5 with use of the central graft, a second operation was required in 2 In the 1 failure nonunion remained and the patient de

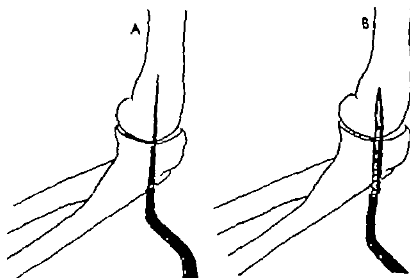


Fig. 41 —Central-graft fusion of elbow joint: *A*, creation of tunnel for central graft with Hatt bayonet osteotome; *B*, driving graft into position. (Courtesy of Van Gorder G W., and Chen, C. M : J Bone & Joint Surg 41 A 1029 1046, September 1959)

clined another operative procedure because he was content with the result

The central graft fusion operation has proved its value and has been most successful in treatment of tuberculous knees and ankles, and reasonably successful in treatment of tuberculous elbows.

Iproniazid in Orthopedics is evaluated by David Bosworth.[8] Psychoses were observed among patients who had been on iproniazid (Marsilid) 4 mg/kg for 4-6 weeks The psychoses were completely reversible on cessation of medication. Iproniazid was found in the cerebrospinal fluid in about 50% greater concentration than in the blood serum Therefore it was believed that when maintaining satisfactory serum levels reactions (psychoses) might be unavoidable to maintain such blood serum levels Gradually at a later period it was concluded that lower dosages of the drug

(8) Dis. Nerv System 19 546-547 December 1958.

could be effective though the action as regards tube was slowed With a starting dose of 4 mg/kg body and reduced within a few days to 2 mg/kg eupho noted but psychoses became rare

Besides inducing euphoria iproniazid effectivel trolled early tuberculosis relieved pain markedly i weight gain reduced temperature with infection p and led to wound healing regardless of the fact tha of the sinus lesions contained not only the tuberculous ism but many other forms of bacteria Decalcificatio seous structure of noticeable extent appeared w months

Decalcification is used to remove sclerosis of infect structure so that contained sequestra may be appr

To determine the effect of iproniazid in the reli pain it was desired to get away from the specific actio gards infected states Therefore the drug was tried i static tumor lesions Some euphoria was achieved I astatic lesions of mesodermal tumors the pain rel dramatic and continued with use of iproniazid accon by moderate euphoria No influence as to the tumo progress was demonstrated

No permanent liver toxicity incidental to use of ipr was noted

On Effectiveness of Marsilid (INPH) in Bone an Tuberculosis Ryosuke Katayama Akira Takayama Ishizuka Jiro Sato Teruya Ohto Kunisato Miyo h Koizumi and Jin Inoue* (Tokyo Jikei Kai School of cine) gave iproniazid (Marsilid) 3 mg/kg body for 8 weeks to 3 patients who had vertebral caric abscess

CASE 1—The quantity of the pus was decreased after on iproniazid and it was impossible to obtain pus after 7 wee specific gravity and percentage of solids also were remark creased The finding of Mycobacterium tuberculosis was throughout 6 weeks but the bacteria count varied. The fluor scopic and culture methods were used. Cultures were nega 1 week after administration of iproniazid. Thereafter cultur positive and the count rose to a peak at the 4th week, then fe end of the 6th week, after which the cultures were negative fluoromicroscopic method the highest bacterial count was at t of the experiment The count fell precipitously for 3 weeks th moderately for 1 week, maintained a plateau for 1 week t

(9) Sea View Hosp Bull 17 6-16 January 1958.

rapidly After 6 weeks no M tuberculosis could be found The sinus was almost closed at 8 weeks and the discharge was negative for tuberculosis organisms by both methods.

CASE 2.—Quantity specific gravity and percentage of solids of the pus were remarkably decreased in 3 weeks on iproniazid The closed abscess likewise became smaller A sinus developed along a needle tract at 4 weeks. The finding of M tuberculosis was positive through the whole 8 weeks by the fluoromicroscopic method but the bacteria count decreased markedly The counting of colonies on culture sharply decreased and cultures were negative in 8 weeks

CASE 3.—There was no change in the quantity specific gravity and percentage of solids of the pus through the whole course Cultural findings as to M tuberculosis were negative at 3 weeks but positive by the fluorescent method until 7 weeks. Thereafter all findings were negative.

In all of the patients the initial anemia increased and serum protein remained unchanged during the 8 weeks The anemia was hypochromic.

Extreme night sweats were noted in 2 of the patients and 1 had accelerated patellar reflex in 5 weeks No other reactions were noted

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BONE TUMORS AND CYSTS

Principles and Technic of Resection of Soft Parts for Sarcoma Sarcomas of soft parts are characterized by absence of true encapsulation by filamentous extension within muscle fasciculi and along contiguous fascial planes and nerve trunks well beyond visible and palpable tumor and by occasional metastasis via the lymphatics Treatment to be locally successful therefore must be aggressive

Lemuel Bowden and Robert J Booher[1] (Mem'l Center for Cancer New York) offer the thesis that the gross anatomic setting of the sarcoma should be the primary criterion for choice of surgical procedure Extensive resection of soft tissue should be carried out for sarcoma regardless of histogenesis when complete removal of the tumor and surrounding soft tissues can be readily accomplished Amputation should be performed for sarcoma regardless of histogenesis when because of proximity to bone joint or principal vessels the tumor cannot otherwise be adequately removed Thus even a small sarcoma in the wrist will probably require amputa

(1) Surgery 44:963-9 December 1958

tion whereas a much larger sarcoma arising in the muscles of the midthigh may be adequately resected with preservation of the leg Resection of soft parts when anatomically feasible for removal of a sarcoma includes wide ablation of *surrounding grossly normal tissue so that no actual tumor is* exposed during its removal Entire muscle bundles surrounding the lesion must be removed at points of origin and insertion The procedure must be carried out by sharp dissection with handling and massage of the tumor reduced to an absolute minimum and with proximal ligation of the major venous tributaries early in the operation

Of *37* patients subjected to extensive resection of soft tissues for *sarcoma 20 are well 2 7 years* after operation In 5 local recurrence was noted within 15 months Nine patients died of disseminated metastases but at no time showed evidence of local recurrence One is living with disseminated metastases but has shown no local recurrence 1 patient was free from local and metastatic cancer when last seen 1 year after surgery and 1 had intrapelvic recurrence *7* years after resection of sarcoma of the buttock

Bilateral Pulmonary Resection for Metastatic Osteogenic Sarcoma Case Report of Seven Year 'Cure In view of the current low mortality and morbidity rates associated with pulmonary resection W K Kumel P R Cutler and W R Halliday[2] (Salt Lake City) believe that the discovery of multiple or bilateral pulmonary metastases should not alone preclude attempts at surgical cure if the total number and distribution of the metastatic lesions is reasonably favorable from a surgical standpoint This policy was successfully *pursued in a patient*

Girl 15 had midthigh amputation for osteogenic sarcoma. Routine x ray films 11 months postoperatively revealed bilateral pulmonary metastases, though she was entirely asymptomatic. Physical and laboratory examinations were negative except for the evidence of amputation. Right middle lobectomy was performed, with removal of a solitary lesion measuring 5 cm. About 3 weeks later left lower lobectomy and lingulectomy with partial pericardiectomy were performed. The lower lobe contained two masses each being 2 cm., and the lingula another which was 4 cm Fibrous adhesions bound the lingular tumor to the pericardium in the region of the phrenic nerve but no gross invasion of the pericardium was present. After the second operation a critical episode of hypotension developed with cardiovascular collapse and hyperthermia of 106 degrees followed by

(2) Dis. Chest 35 106 109 January 1959

oliguria, from which she recovered fully The histologic appearance of the pulmonary lesions was identical to that of the primary femoral tumor Subsequently she has been normally healthy and active in all respects. No clinical or x ray evidence of recurrence developed for more than 7 years after the second resection

The variation in the size of the nodules strongly suggested that more than one and probably three episodes of tumor embolization took place before extirpation of the primary tumor The appearance of multiple bilateral lesions up to 5 cm in diameter within a year after resection of the primary growth would indicate that the tumor was not one of unusually low-grade malignancy but an ordinary osteogenic sarcoma Microscopic characteristics favored this contention Despite these considerations which would detract from the likelihood of success the result obtained satisfied the usual criteria of a 7 year cure after resection of multiple bilateral pulmonary metastases arising from a primary osteogenic sarcoma of the lower end of the femur and indicates that presence of such metastases does not necessarily preclude the possibility of cure after surgical excision

Treatment of Malignant Tumors of Extremities by Perfusion with Chemotherapeutic Agents Edward T Krementz Oscar Creech Jr Robert F Ryan and Jack Wickstrom[3] (New Orleans) performed 45 perfusions in 37 patients including 17 with malignant melanoma 17 with some type of sarcoma and 3 with primary or metastatic carcinoma of the extremity The dosages recommended for perfusion of the common femoral artery are listed in the table Several factors are of importance in determining the maximum amount of an agent that can be given by this technic. The lower extremity perfused through the common femoral artery will tolerate the usually recommended systemic dose This represents a six to eightfold increase in concentration of the drug because the lower extremity constitutes one sixth or less of the total body mass Animal experiments suggest that the amounts of chemotherapeutic agents may be increased beyond the limits described and in recent clinical experience this has been done without any apparent increase in toxic effects. If the patient is obese or has had previous chemotherapy or irradiation the dosage should be lowered. If perfusion is to be confined to a smaller area than that supplied by the common femoral artery the dosage

(3) J Bone & Joint Surg 41 A 977 987 September 1959

should be reduced Thus though 0.8 mg/kg body weight nitrogen mustard would be used for perfusion of the common femoral artery the dose would be reduced to 0.4 or 0.6 mg/kg body weight for perfusion of the axillary artery

Of the 17 patients with malignant melanoma in 14 the disease was confined to the lower extremities and in 3 to the upper extremity Of 13 patients treated for palliation 3 are dead Of these 3 2 had the local tumor controlled by perfusion but subsequently died of distant metastases and 1 died of an excessive dose of phenylalanine mustard with inadequate isolation of the extremity Of the 10 survivors who had been treated for palliation 3 have recurrent disease and in 7 the disease is considered quiescent Four patients with melanoma had perfusion as an adjunct to surgical excision In 3 of the 4 the disease is controlled and 1 had local recurrence with the appearance of a satellite nodule outside of the grafted area The nodule was excised and no further activity has been noted

DOSAGE FOR COMMON FEMORAL ARTERY
ISOLATED PERFUSION

	MG./KG. BODY WEIGHT
Nitrogen mustard	0.8
Phenylalanine mustard	1.5
Actinomycin D	0.5
Triethylene thiophosphoramide	0.8
5-fluorouracil	20.0

Of the 17 patients with sarcoma of the extremities 13 were treated for palliation whereas in 4 perfusion was an adjunct to surgical excision Of the 4 1 died whereas of the 13 5 died

Local complications in the extremities were relatively minor When the dosage was high intense erythema occurred followed by brawny edema similar to that observed after x-ray therapy This is to be expected because the alkylating agents exert effects similar to those of ionizing radiation. The administration of cortisone speeds resolution of this process Systemic complications were minimal

► [Although it may be unwise to draw conclusions regarding the behavior of specific cases of melanoma, since the disease behaves so strangely in different people certainly this new approach to the problem is interesting and should be watched for further developments.—Ed.]

Eosinophilic Granuloma Case Report is presented by I M Farin and Y Rotem[4] (Government Hosp Tel Hashomer Israel)

(4) Acta orthop scandina 28 124 130 1958



Fig. 42.—Flattening of bodies of 3d, 8th and 9th dorsal vertebrae. (Courtesy of Farin, I. M., and Rotem, Y : Acta orthop. scandinav 28 124-130 1958)

Boy 2, had a small swelling over the dorsal spine. X ray examination showed destruction of the body of the 8th dorsal vertebra. The Mantoux test was positive. A diagnosis of tuberculosis was made, and a plaster jacket was applied. During the next 2 years 24 foci were observed in the vertebral column (Fig 42) ribs right scapula, skull pelvis, right radius and femora. Most foci manifested swelling tenderness and pain, accompanied by fever and malaise, but some were silent and discovered accidentally Biopsies of a skull and a rib lesion showed changes compatible with diagnosis of eosinophilic granuloma. Acute signs disappeared within 3-4 weeks but x ray findings persisted 5-18 months before bony reconstruction occurred. Skeletal survey at age 5 showed that all foci except those in the spine had disappeared without treatment.

Vertebra Plana in Children Produced by Xanthomatous Disease Joseph D Calhoun and S B Thompson[5] (Little Rock, Ark) observed 4 children with vertebra plana 1 had a solitary lesion in a vertebral body, accompanied by severe neurologic changes 1 had what was thought to be a solitary lesion but routine biopsy of the vertebrae above and below revealed unsuspected involvement of the subjacent body and the other 2 patients presented multiple lesions in the skeleton Histologic diagnosis was eosinophilic granuloma and Hand Schuller Christian disease.

Xanthomatosis is a term that has been suggested to include the three diseases commonly known as eosinophilic granuloma Hand Schüller Christian disease and Letterer Siwe disease. Perhaps the three diseases are merely "different clinicoanatomic expressions of the same basic disorder" as suggested by Jaffe and Lichtenstein and eosinophilic granuloma merely represents the chronic phase Hand Schüller Christian disease the intermediate phase and Letterer Siwe disease the acute phase as suggested by Goodhill

Most of the cases reported are in children aged 2 10. Often the history reveals a rather trivial fall with rather insidious development of mild back pain and malaise The physical findings are usually minimal with only mild tenderness muscle spasm and gibbus deformity Little is to be gained from laboratory procedures The vertebral lesion may even be discovered incidentally with the clinical findings pointing to other areas of involvement as in 1 of the authors patients

Some of the more constantly recurring x ray findings are involvement of a single vertebra with the body reduced to a wafer thin disk preservation or slight widening of the intervertebral cartilage spaces immediately above and below the lesion slight increase in the anteroposterior diameter of the involved body mild kyphosis at the involved level, a relative sparing of the posterior elements and a period of regeneration that lasts for many months in which the vertical height is nearly or completely restored These findings more or less hold for the authors patients except that no appreciable degree of restoration of the normal vertical height was noted.

The authors observed a gentle, fusiform swelling of the

(5) Am J Roentgenol. 82 482-489 September 1959

paraspinous soft tissue shadows extending a vertebra or so above and below the lesion This shadow was striking in all but 1 of the 4 patients

► [Histiocytosis (X) is a much better and more up-to-date name for the diseases mentioned —Ed.]

Treatment of Giant Cell Tumor of Bone was reviewed by Einer W Johnson Jr, and David C. Dahlin[6] (Mayo Clinic and Found) in 116 consecutive patients aged 12 71 Women predominated in the ratio of 64 52. Sixty three of the tumors occurred in the upper portion of the tibia or the lower portion of the femur with the femur being affected most commonly The third commonest site was the sacrum (11 tumors) and the fourth the lower portion of the radius (9 tumors)

Because many of the patients received multiple forms of treatment, all were grouped arbitrarily into five categories according to the primary treatment given (1) patients treated by curettage (2) patients treated by excision in which the entire tumor and its encasing shell of bone were removed (3) patients treated by amputation (4) patients treated by irradiation and (5) of 2 patients who fitted in none of the preceding categories 1 had biopsy and aspiration only and 1 had biopsy and Coley s toxin, both died

The 71 patients treated by curettage were subjected to 146 separate treatment sessions Many combinations of treatment were used for these patients including curettage with or without grafts pre- and postoperative radiation therapy and chemical cautery of the cavity None of these ancillary measures influenced the recurrence rate in this group Amputation became necessary as a secondary procedure in 14 of the patients treated by primary curettage Secondary sarcoma massive recurrence and persistent draining and disabling lesions were the reasons for amputation Successful results from curettage were obtained in only 30 of the 71 patients In the 41 patients the tumor was judged to have recurred because additional treatment was necessary 3 or more months after completion of the primary therapy

In 14 patients treatment was primarily by excision and in 4 others the tumor was completely excised after failure of curettage and ancillary measures No recurrences developed in 12 of these patients during average follow up of 16.2 years

(6) J Bone & Joint Surg 41 A:895-904 July 1959

Irradiation after biopsy was the primary form of treatment in 13 patients Irradiation did not control the tumor in any of these patients

Amputation was the primary form of therapy in 16 patients The reasons for amputation included mistaken diagnosis of malignant disease, extensive bone destruction severe disability infection and hemorrhage Of these 16 patients 14 were followed for more than 5 years 3 died of unrelated causes

Hemangioma of Synovial Membrane Royce C Lewis Jr, Mark B Coventry and Edward H Soule[7] reviewed data on 11 patients with hemangioma of the synovial membrane seen at the Mayo Clinic during 50 years The hemangioma occurred in the knee in 9 patients and in the ankle and elbow in 1 each Mean age at onset was 5.3 years and mean duration of symptoms was 15 years

Tenderness occurred in all being diffuse in a few and well localized in most Pain on motion occurred in all of the patients Pronounced atrophy of the quadriceps was present in 7 of the 9 patients with knee involvement In 2 of these the instability occasioned by the atrophy was the major complaint No explanation has been offered for this extreme atrophy which seems out of proportion to the amount expected from disuse alone Many investigators have commented on the existence of the extreme atrophy which probably is one of the most important clinical signs of synovial hemangioma of the knee

A mass was felt in the patients with hemangioma of the elbow and ankle and in 6 of the 9 with knee involvement It was diffuse and poorly defined in most instances The mass felt doughy in 3 patients smooth and cystic in 1 and in 1 like localized effusion

In most of the patients the x ray appearance was normal or was that of varying degrees of osteoporosis In a few patients there was increased soft tissue density

In all the lesions were removed surgically In 4 the tumors were localized complete removal was followed by apparent cure In 4 of the 7 patients with diffuse involvement complete removal was not possible Of the 4 patients 3 had recurrence and 1 was last heard from 2 months after surgery No recurrences were observed during follow up of 2 3 years

(7) J Bone & Joint S rg 41 A 264 271 March, 1959

in the 3 patients in whom the diffuse tumors could not be completely removed

The efficacy of roentgen therapy could not be evaluated because only 4 patients were so treated Two of these were patients in whom incomplete removal of diffuse tumors had been followed by roentgen therapy and subsequent recurrence that necessitated additional operation

Osteoid Osteoma Report on 80 Cases is presented by Robert H Freiberger Bernard S Loitman Milton Helpern and T C Thompson[8] (New York Hosp Cornell Univ Med Center) The most prominent symptom was pain which

LOCATION OF OSTEOID OSTEOMA

Location Bone	1945 Jaffe	1947 Sherman	1944 Lewis	1949 Caley and Lennox	1951 Dockerty et al	1953 Jackson	1954 Ban-kerar	1957 Present Authors
1 Tibia	17	4	3	7	16	60	15	9
2. Femur	14	7	3	2	30	52	6	18
3. Vertebra	4	7	1		1	20		3
4. Humerus	5	1	1		5	6	3	2
5. Talus	3	1				1		2
6. Phalanx Hand	2	4	1	1		10		8
7 Phalanx Foot	3	3				9	1	
8. Calcaneus						8		2
9. Fibula	6		1			8	1	3
0. Radius	1	1				5		
Ulna	2				2	5		5
1. Ilium		1	1		2	3	3	2
3. Carpal navicular						2		
14. Tarsals	1				3	2		
5. Ankle site	1					1		
6. Mandible					1	1		
7 Metatarsals						1	1	1
8. Metacarpals							2	1
19. Patella	1					1		1
20. Pubis		1				1		
21. Rib						1		
22. Scapula					2	1		1
3. Ischium								1
Total	62	30		10	62	218	32	80

represented the chief complaint of all of the patients The pain improved with activity but worsened with rest It was not always localized to the lesion site Relief from pain after small doses of aspirin was so common that it was regarded as a significant diagnostic feature No significant causal relationship could be established between trauma and the tumor

Physical findings varied with the lesion site (Table) Lesions of the phalanges consistently presented with pronounced fusiform soft tissue swelling that involved an area greater than the bone lesion observed on x rays Lesions of

(8) Am. J Roentgenol. 82 194-205 August, 1959

the long bones of the extremities also produced swelling of the soft tissues Limp and limitation of joint motion occurred in 25 of 57 patients with osteoid osteoma of the lower extremities Systemic toxicity as reflected by fever elevated blood sedimentation rate and leukocytosis was not encountered Sex distribution was about 2 males to 1 female About 90% of the patients were under age 25

The characteristic x ray appearance of osteoid osteoma



Fig 43 —Osteoid osteoma in femur of boy 7 Pain of 2 years duration in right hip and right knee was relieved by aspirin Anteroposterior (*A*) and lateral (*B*) x rays reveal radiolucent nidus asymmetrically surrounded by sclerotic bone (Courtesy of Freiberger R. H., *et al.* Am. J Roentgenol. 82 194 205 August, 1959)

consists of a radiolucent center representing the osteoid nidus surrounded by a zone of radiopacity representing the perifocal sclerotic bone (Fig 43) The size of the nidus and width of the sclerotic zone vary greatly depending on the anatomic location and possibly the age of the lesion

At operation the lesion has a distinctive appearance A dark red circular or oval center is surrounded by an ivory white margin of dense bone Microscopically the nidus consists of osteoid tissue supported by an extremely vascular connective tissue stroma It is surrounded by dense bone trabeculae that extend into the osteoid tissue at its margins.

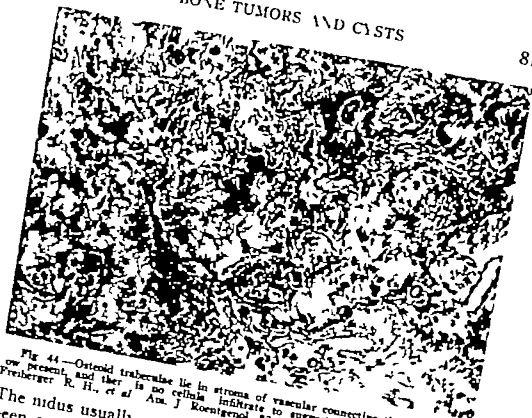


Fig 44—Osteoid trabeculae lie in stroma of vascular connective tissue. No marrow present, and there is no cellular infiltrate to suggest infection. (Courtesy of Freiberger R. H., *et al* Am. J Roentgenol. 82 194-205 August, 1959)

The nidus usually contains calcified osteoid tissue that has been converted into atypical bone. It never contains bone marrow There is no polymorphonuclear cell infiltration no pus and nothing to suggest infection (Fig 44)

Eventual spontaneous healing with gradual disappearance of pain does occur in the natural progression of this disease Data on the few cases reported indicate that the nidus disappears but that some bone sclerosis and cortical thickening persists Because the duration of pain and the natural progression of the disease are so unpredictable surgical excision is the treatment of choice

Osteoid Osteoma A 15-Year Follow up of Untreated Patient was carried out by Charles W Vickers David C Pugh and John C Ivins[9] (Mayo Clinic and Found.)

Man 23 was seen in 1943 because of deep, boring pain in the right thigh and lower back of 5 years duration. The pain, more severe at night was partially controlled by aspirin, but was unaffected by external treatment to the extremity X ray of the upper part of the right femur (Fig 45 *A*) revealed fusiform thickening of the cortex in the subtrochanteric region, in the center of which was a nidus 1 cm. in diameter The lesion was an osteoid osteoma or osteomyelitis and

(9) J Bone & Joint Surg 41 A 357 358 March, 1959

surgery was recommended The patient agreed to return for surgery but did not return until 1958 The pain had persisted for the entire 15-year interim but had diminished progressively At the second visit, the patient was almost symptom free An x ray (*B*) showed little change in the appearance of the lesion The degree of involvement was unchanged but the nidus was somewhat less radiolucent No

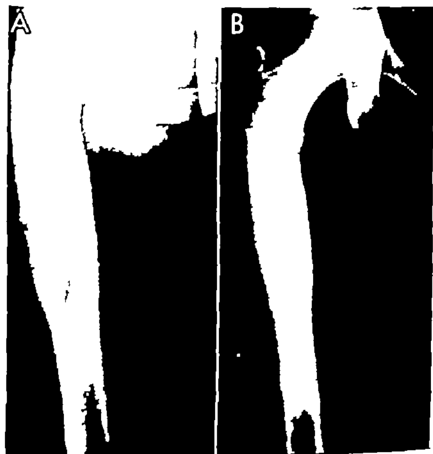


Fig 45 Upper part of right femur *A* In August 1943 *B* August, 1958. (Courtesy of Vickers, C W et al J Bone & Joint Surg 41 A 357 358, March, 1959)

definitive treatment was recommended. After reviewing the history and x rays it was agreed that the lesion was an osteoid osteoma.

Six other cases have been reported in the literature in which untreated osteoid osteoma was observed from the painful phase until the patient was relatively symptom free. This period varied from 2 years in 2 of the patients reported on to 20 years in the present patient Review of the serial x rays on the reported cases suggests that the nidus as the lesion heals becomes less radiolucent but that the region of cortical reaction around the nidus does not resolve

Because the lesion regressed spontaneously in all of the reported cases and almost certainly does so in all untreated patients the theory that the lesion is a true neoplasm might be questioned The self limiting characteristics of the condition would tend to place it in the category of an inflammatory lesion but the microscopic picture is not one of infection In view of present knowledge it is not possible to place the disease in any specific category

Early Juxtacortical Osteosarcoma (Parosteal Osteoma), according to Sheldon A Jacobson[1] (Univ of Oregon) often arises if not uniformly as an osteochondroma like lesion The initial lesion may be differentiated from simple osteochondroma by the irregular development of masses of connective tissue fibrocartilage and osteoid in and on the cartilaginous cap of the lesion and by more than a minimal amount of connective tissue stroma in the marrow cavity of the bony stalk.

The tumor has apparently from inception a less limited growth potential than does the classic cartilaginous exostosis Quite early therefore growth may proceed away from and into the bone The tumor tends to recur after excision and to malignant degeneration It is not yet certain however that resection of the early tumor is followed by malignant recurrence in all patients The disease could be in essence premalignant analogous to certain dermatoses whose further progression is not inevitable Judgment must be withheld because of the relatively recent appearance of the disease in some patients and the small total number submitted to date

Definite advice concerning treatment cannot be given For the time being Jacobson advises wide excision of the original lesion On recurrence a more aggressive attack is recommended If confirmatory evidence of the relation between these tumors and fully developed sarcoma should appear recurrence of the lesion would be an indication for amputation Though there has been little experience with radiation therapy in this disease when the lesion is surgically inaccessible and shows ominous tendencies irradiation may be attempted

Eight cases of juxtacortical osteosarcoma are reported. In 6 patients the initial lesion resembled an osteochondroma in

(1) J Bone & Joint S rg. 40-A:1310-1328 December 1958.



Fig 46.—Rounded, calcific exostotic lesion suggestive of sessile osteochondroma in woman 26 (Courtesy of Jacobson S A. J Bone & Joint Surg 40-A 1310 1328, December 1958)

general appearance (Fig 46) In 4 the lesions were phalangeal tumors 3 were femoral and 1 was vertebral all of which entailed serious consequences The saving grace in digital growths such as those noted in the first 4 patients may be the fact that they are observed and removed in a quite early stage

► [I asked Dr David Dahlin to review the articles on bone tumors and he does not believe that the digital examples given in this article are true juxtacortical osteogenic sarcomas or "parosteal osteomas" The theory as to how these lesions begin is still in extreme doubt. Certainly irradiation of these tumors is of no value and in most cases amputation will ultimately be necessary if one is to effect a cure —Ed]

Ewing's Sarcoma of Toe was observed by Albert R. Andrisek[2] (St Vincent s Charity Hosp Cleveland) in a patient.

Youth 20 complained of pain and redness of the large toe on the right foot, which had been present for about 2 weeks. Physical findings on examination were essentially negative, except those of the large toe which appeared reddened and tender under pressure with some swelling and apparent induration X rays of the toe showed

(2) J.A.M.A. 170 189 191 May 9 1959

dense proliferation of the proximal phalanx. X rays of the hands, left foot, pelvis (both hip joints) and chest were negative.

Microscopic sections of the biopsy specimen showed thick anastomosing cords and sheets of small cells forming broad collars around small vascular spaces. The cells were fairly uniform in size shape and staining quality They showed scanty pale pink to stainless cytoplasm with indefinite cell borders. The nuclei were prominent, oval to round and occasionally irregular They varied slightly in staining quality but in general were pale with somewhat darker borders. Occasional nucleoli were identified and mitotic figures were not uncommon. The cells were compact in some areas but more loosely arranged in others. Though they surrounded vascular spaces, they did not encroach on the walls of the blood vessels whose lumens were free from tumor cells. Formation of fibrous septa occasionally gave the tumor an alveolar appearance.

Decalcified sections showed thick, bony trabeculae surrounded by fibrous tissue infiltrated by loosely arranged nests of tumor cells Occasional cells infiltrated marrow spaces that were undergoing fibrosis. No multinucleated giant cells of tumor origin were identified Diagnosis of Ewing's sarcoma was made.

Disarticulation of the proximal phalanx with removal of one third of the metatarsal was done. X rays taken 8 months later showed metastasis to the right hip joint and left ribs. Palliative x ray therapy (250 kv to the right hip and ribs) was begun. There was partial response with decrease in the size of the lesion and some alleviation of pain The patient died about 14 months after diagnosis was made.

Because the cause is obscure and the disease is primarily one of childhood youth and early adult life rarely observed in persons over age 25 the clinical features of pain variable in intensity with a lump or swelling can be confused with a bone infection Primary bone sarcoma of a phalanx is so rare as to be considered almost nonexistent. Unfortunately despite control of the primary tumor metastases nearly always develop later Though these in turn yield to treatment the patient dies during the continuing hopeless struggle to keep up with the widespread disease by radiation therapy Progress of the disease varies markedly being exceedingly rapid in some patients whereas in others fatal termination may be long deferred.

Malignant Synovioma. A Kastelein and J A. M Van Unnik[3] (Rotterdam) report 7 cases of malignant synovioma with a review of the literature This tumor may appear at any age No specific etiologic factors have been discovered Trauma has been reported in some cases but a causal association has not been proved There was no history of injury

(3) Nederl tijdschr geneesk. 102 2263-2268 Nov 15 1958.

in the authors patients Sites of predilection of malignant synovioma are the knee foot thigh ankle and hand Often the tumor is not connected with the joint capsule but is extra articular, presumably originating in a tendon sheath or bursa There are no pathognomonic symptoms. Most patients note a swelling and local pain Insidious onset and slow growth are remarkable Usually the tumor is small 3-6 cm in diameter sharply delimited but not freely movable Its apparently benign character accounts for the long delay in seeking treatment averaging 2 3 years One of authors patients had pain at the site where the tumor later developed for 20 years

The joint capsule consists of connective tissue whereas the cells that line the joint cavity show somewhat epithelial differentiation Synoviomas show a variety of histologic pictures and have been reported as sarcoma of various cellular types—alveolar reticulum-cell fibrous fibro xanthomatous —Ewing's sarcoma and malignant endothelioma Metastases occur via the hematogenic route and occur principally in the lungs other sites are skeleton and lymph nodes

Any soft tissue tumor in the vicinity of a joint may be a synovioma especially in the knee and foot regions this possibility should be considered X rays are not characteristic At times there is calcification which is visible on the x ray Neighboring bone may be involved in an osteolytic process Diagnosis must be confirmed by biopsy

Treatment in the 7 patients was by excision and/or irradiation followed in some by amputation Six of the patients died 5 due to metastases 4 months to 5 years later and 1 1 year after amputation following a biopsy One patient had no signs of recurrence or metastasis 1 year after treatment.

These cases and those reported by others indicate that there is no best method of treatment that can be safely recommended None give ideally satisfactory results Radical operations do not improve results sufficiently to compensate for the mutilation and psychic trauma. Though this tumor is only slightly radiosensitive the clinical impression is that in several instances postoperative irradiation has improved the prognosis

All things considered wide excision of the tumor and immediate surrounding tissue, followed by intensive roentgen irradiation is the treatment of choice When wide excision

is technically impossible or in case of recurrence more radical procedures may be used such as amputation. When surgery is impossible irradiation alone is used but little benefit can be expected from this.

► [When one is dealing with a malignant synovioma or synovial cell sarcoma one cannot temporize. Certainly at present amputation is the procedure of choice. It may be that in certain instances local resection may be of value but these are isolated instances. The tumor is resistant to x ray treatment so my personal opinion would be that either pre- or postoperative x ray treatment of the lesion is of no value and only an added expense to the patient.—Ed.]

ARTHRITIS AND RHEUMATISM

► ↓ The various tests for rheumatoid factor (as shown in the next 4 papers) are not exactly comparable and do not always test the same factor. This fact plus the false "positive" results in other diseases, especially those with high gamma globulin fractions and the negative results, especially in early cases where diagnostic help is most needed, emphasize their limited usefulness as diagnostic measures. They must be used only as additional suggestions not as certified guides to diagnosis.—John G. Mayne.

Isolating the Rheumatoid Factor. The most important tests presently available for differential diagnosis in rheumatoid arthritis are the agglutination reaction with sensitized sheep blood cells and modifications, the most important of which are Singer's and Plotz's latex test and Bunim's bentonite reaction. These modified tests, however, are apparently less specific for rheumatoid arthritis than the ordinary hemagglutination reaction. Bunim found that the bentonite reaction occurred in 66% of cases of lupus erythematosus disseminatus. These tests are suitable as initial survey tests in about the same way as are flocculation tests in syphilis. The hemagglutination reaction also occurs sometimes in other collagen diseases and in widely different forms of disease such as hepatitis and ulcerative colitis.

By use of cold fractionation, zone electrophoresis, chromatography with a cation exchanger and ultracentrifugation, Nanna Svartz[4] (Stockholm) succeeded in purifying to a high degree and even apparently in isolating the rheumatoid factor (RF), which is a macroglobulin with a sedimentation constant of about 18.7 S.

Although further knowledge of the physicochemical properties of the rheumatoid factor is of extreme interest, the pre

(4) Acta rheumat. scandinav. 5:5-11, 1959.

dominant clinical question is whether the factor tells us anything about the pathologic process and the course followed by rheumatoid arthritis It can be asserted that a high hemagglutination titer does not indicate sound protection against the disease—rather the contrary A high titer is observable primarily in severe cases of the disease Many hold that if a patient has once had a positive hemagglutination test it will remain so for the rest of his life But this does not seem to be true If a person with rheumatoid arthritis recovers not only symptomatically but actually the rheumatoid factor may disappear entirely from the blood or become considerably reduced No major decrease in titer has ever been observed before patients have shown marked improvement for at least 6 months

Appraisal of Latex Test for Rheumatoid Arthritis is presented by M R Jeffrey[5] (Tulane Univ) Serum from patients with rheumatoid arthritis has been found to agglutinate a variety of particles or enhance their agglutination by other agents Several tests have been developed that depend on this phenomenon and have usually used partially sensitized sheep red cells as the indicator of agglutination-enhancing activity For a routine laboratory however sheep cells are not an ideal reagent. Use of polystyrene latex particles coated with human gamma globulin as the indicator of agglutination has the advantages of simplicity and stable reagents

In the sheep cell and latex tests the serum of 1 of 3 or 4 patients with clinically typical rheumatoid arthritis fails to show agglutination If instead of whole serum a euglobulin fraction is used agglutination of sensitized sheep cells occurs in about 9 of 10 patients with rheumatoid arthritis and in only 2% of the controls A further modification giving a still more sensitive but less specific test, consists of examining the euglobulin fraction for a factor that inhibits the agglutinating activity of known rheumatoid serum This inhibitory factor is said to be absent almost invariably from rheumatoid serum and to be present in most normal serums.

It seemed that a combination of these tests might be found that was reasonably simple yet possessed high accuracy The author therefore used the latex technic to estimate the content of agglutinating and inhibitory factors in the euglob-

(5) J Lab. & Clin. Med 54 525 534 October 1959

ulin fraction and the whole serum of some healthy subjects some patients with rheumatoid arthritis and some with other diseases

The latex test was found to be the equal of the sheep cell test in diagnosis of rheumatoid arthritis and its technical advantages and substitution of a biologically inert particle for the sheep red cell make it preferable Its frequent diagnostic failure in juvenile rheumatoid arthritis and the overlap in patients with collagen diseases remain as challenges to investigation and improvement

Clinical Significance of Rheumatoid Serum Factor was investigated by J H Kellgren and J Ball[6] with the assistance of Frida Bier Since 1949 the rheumatoid serum factor has

TABLE 1—DEFINITE RHEUMATOID ARTHRITIS INPATIENTS 1952 57 SHEEP CELL AGGLUTINATION TEST RESULTS

Nodules	Males Total No.	Males Positive No.	Males Positive %	Females Total No.	Females Positive No.	Females Positive %	Both Sexes Total No.	Both Sexes Positive No.	Both Sexes Positive %
Original Diagnosis—First Test—Any Duration									
Nodular	62	62	100	91	84	92	153	146	95
Non-nodular	87	73	84	153	121	78	240	194	81
Total	149	135	90	244	205	84	393	340	87
Original Diagnosis—First Test—Duration under 1 Year Only									
Nodular	7	7	100	7	5	71	14	12	86
Non-nodular	22	14	64	28	19	68	50	33	66
Total	29	21	72	35	24	69	64	45	70
Revised Diagnosis—Highest Test—Any Duration									
Nodular	62	62	100	90	87	97	152	149	98
Non-nodular	83	77	93	147	130	88	230	207	90
Total	145	139	96	37	217	92	382	356	93

been estimated by sheep cell agglutination in serums from all patients admitted to the rheumatism beds of the Manchester Royal Infirmary and from selected outpatients The test has also been carried out on serums collected during surveys of random and screened samples of the general population

A positive sheep cell agglutination test was found in 93% of 382 inpatients with rheumatoid arthritis (Table 1) Of

(6) Brit. M J 1 523-531 Feb. 28 1959

TABLE 2—DIFFUSE CONNECTIVE TISSUE AND VASCULAR DISEASES IN- AND OUTPATIENT 1949-57 FIRST SHEEP CELL AGGLUTINATION TEST RESULT—ORIGINAL DIAGNOSIS

Diagnosis	Total No	S.C.A.T. Positive No	S.C.A.T. Positive	Mean Age	Females No	Females
Systemic lupus erythematosus	41	17	41	38	36	88
Systemic sclerosis and scleroderma	39	16	41	40	32	82
Digital endarteropathy	25	11	44	46	22	88
Dermatomyositis	16	2	13	34	12	75
Polyarteritis nodosa without R.A.	11	0	0	36	6	55
Polyarteritis nodosa with R.A.	4	3	75	52	1	25

TABLE 3—OTHER SELECTED DISEASES IN- AND OUTPATIENTS 1949-57 FIRST SHEEP CELL AGGLUTINATION TEST RESULT—ORIGINAL DIAGNOSIS

Diagnosis	Total N	S.C.A.T. Positive No	S.C.A.T. Positive	Mean Age	Females N	Females
Rheumatic fever	59	3	5	8	43	73
Ankylosing spondylitis	537	23	4	36	99	18
Atypical ankylosing spondylitis	139	16	1	38	5	18
Valvular heart disease with spinal arthritis	1	0	0	37	13	6
Psoriasis and arthritis	62	11	18	43	34	55
Gouty arthritis	57	4	7	55	9	16
Rheumatoid polyarthritis with hyperuricaemia	6	6	100	49	2	33
Reiter's disease	5	4	8	39	7	11
Atypical polyarthritis	31	4	13	44	23	74
Pulmonary osteoarthropathy	6	1	17	61	0	0
Osteoarthrosis	83	18	6	57	222	78
Neuropathic arthropathy	5	1	20	54	3	60
Disk lesions	57	1	2	47	30	53
Tuberculous arthritis	21	1	5	33	9	39
Gonococcal	4	0	0	25	2	50
Shoulder syndromes	19	1	5	52	15	79
Erythema nodosum	3	0	0	33	0	0
Intermittent hydrarthrosis	6	0	0	47	4	67
Acromegaly	14	0	0	31	5	36
Osteochondritis	4	0	0	14	3	31
Marfan's syndrome	3	0	0	18	2	66
Morquio's	3	0	0	23	1	33
Alkaptonuria	1	0	0	55	1	100
Behcet's disease	2	0	0	38	0	0
Total	1,392	94	6.7	42	549	39

these 152 had subcutaneous nodules, 98% of whom had positive tests. Positive tests were obtained in 70% of 64 patients who had had rheumatoid arthritis for less than 1 year and in 68% of 11 patients with rheumatoid arthritis in whom an alternative diagnosis was recorded at some stage of their hospitalization. In both groups diagnosis was less certain, and this is reflected in the lower proportion of positive tests.

Some 40% of positive tests were found in patients with systemic lupus erythematosus systemic sclerosis and a form of endarteropathy affecting the digital or pulmonary vessels (Table 2) but the sheep cell agglutination test was usually negative in other arterial diseases and in dermatomyositis A positive test was found in only 6.7% of serums from 1 392 patients hospitalized for other forms of arthritis (Table 3) though many of these patients such as those with atypical spondylitis Reiter s disease and psoriatic arthropathy had severe inflammatory erosive polyarthritis which resembled rheumatoid arthritis in many respects

TABLE 4—SHEEP CELL AGGLUTINATION TEST RESULTS BY SEX AND AGE GROUP IN 1 IN 30 RANDOM SAMPLE OF ADULT POPULATION OF LEIGH ENGLAND

Age Group	Males					Females				
			Positive					Positive		
	Sample No.	Tested No.	No	% of Tested	% of Sample	Sample No.	Tested No.	No.	% of Tested	% of Sample
15–24	55	48	0	0	0	65	56	2	4	3
25–34	131	113	5	4	4	115	98	5	5	4
35–44	127	103	2	2	2	148	119	4	3	3
45–54	169	146	9	6	5	171	140	11	8	6
55–64	102	88	4	5	4	139	101	6	6	4
65+	91	75	11	15	12	115	78	7	9	6
Not stated	6	—				5	—			
Total	681	573	31	5 4	4·6	758	592	35	5 9	4 6

A positive test was found in 5.7% of 1 165 serums from a random sample of the adult population of a Lancashire town (Table 4) In this population positive tests were fairly evenly distributed between the sexes and throughout the age groups tested although the proportion of positive tests was somewhat higher in older and lower in younger subjects Positive tests showed a substantial degree of familial aggregation being found in 20% of 94 blood relatives of propositi with positive tests

The rheumatoid serum factor may represent an index of some inherited metabolic characteristic which predisposes the person to rheumatoid arthritis and certain other diseases that may not yet be fully defined Conversely many other forms of inflammatory erosive polyarthritis appear to be unrelated to this characteristic

Rheumatoid Factors were studied by Henry G Kunkel[7] (Rockefeller Inst) The term rheumatoid factors has been applied to a class of closely related proteins that are responsible for a variety of serologic reactions currently used for diagnosis of rheumatoid arthritis The evidence that these factors are involved in a direct causative manner in the joint lesions of rheumatoid arthritis is extremely scanty Their occurrence in a wide variety of disorders other than rheumatoid arthritis though at a lower incidence argues against such a concept. Certain patients with liver disease sarcoidosis syphilis parasitic disorders and various other conditions associated with hyperglobulinemia may contain rheumatoid factors at an incidence of anywhere from 10% to 50% depending on the sensitivity of the test used In rheumatoid arthritis the incidence using the same tests ranges from 60% to 95%

With isolation of the rheumatoid factors it became apparent even with relatively crude preparations that these factors represent macroglobulins with a rapid sedimentation rate in the ultracentrifuge Through preparative ultracentrifugation ion exchange chromatography and elution from sensitized sheep cell complexes various workers have isolated a macroglobulin with a sedimentation coefficient of about 19 S that represents the active material Chromatography experiments indicate that more than one macroglobulin is involved These macroglobulins have proved to be gamma globulins with chemical physical and antigenic properties similar to the normal 19 S class of gamma globulins a fraction of serum that is known to contain a variety of antibodies The isolation work has added further weight to the concept that these factors represent antibodies They appear similar to such antibodies as certain of the isoagglutinins cold agglutinins saline Rh agglutinins *certain of the* typhoid agglutinins Wassermann antibody and many others that fall in the high molecular weight class

If they represent antibodies then what is the antigen involved? This remains an enigma though some evidence suggests that they might be antibodies to ordinary gamma globulin or antiantibodies

Physical Findings in Early Rheumatoid Spondylitis are

(7) A.M.A. Arch. Int. Med 104 832-836, November 1959

discussed by Stanley L. Wallace[8] (State Univ of New York New York City) Rheumatoid spondylitis is a systemic in flammatory disease occurring with greatest frequency among young men and characterized by involvement of the sacroiliac joints and apophysial joints of the spine. Arthritis of the peripheral joints may occur in about 25% of the pa tients with this disease Rheumatoid spondylitis may be in termittent or chronically active and often is progressive with ascending involvement of the spine.

Rheumatoid spondylitis may present as low back or glu teal pain The character of the pain may be variable. It may be a short acute stabbing or sharp pain occurring at inter vals with periods of freedom or a persistent ache with acute exacerbations There may be sciatic radiation of the pain and the sciatic syndrome may be alternating or bilateral Fibrositic stiffness in the low back often occurs The symp toms are usually insidious in onset X ray signs such as the characteristic involvement of the sacroiliac joint may not appear in some patients until several years after symptoms have begun.

Wallace studied 22 patients with rheumatoid spondylitis early or nonadvanced. Of these, 18 had x ray abnormalities limited to the sacroiliac joints only 1 had peripheral joint involvement Limitation of lumbar spine motion was re- vealed in 8 patients and only 4 of the 22 had difficulty in expanding the chest on deep inspiration

Only three physical abnormalities occurred among more than 50% of the 22 patients Lumbar paravertebral muscle spasm and tenderness were present in 12 patients, 18 had tenderness on percussion or deep palpation over the sacroil iac joints and 17 had local sacroiliac and/or gluteal pain produced by iliac crest compression and separation The first of these is nonspecific and occurred in many of the 50 con trols with various other low back disorders

The iliac crest compression and separation maneuvers tended to reproduce the type and location of distress that occurred spontaneously in these patients. Reproduction of symptoms by the maneuvers correlated well with the pres ence of active clinical disease in the sacroiliac joints When there was no other clinical evidence of active sacroiliitis

(8) New York J Med. 59:2379 2382 June 15 1959

even in advanced fusion and sclerosis of the joints on x ray the iliac crest maneuvers did not produce symptoms

► [*As the author comments any disease giving sacroiliac joint disease would give positive results with these tests It would seem that the important historical features e g nocturnal back pain and morning stiffness plus paravertebral spasm and limitation of spine motions on physical examination are the most important features in the early diagnosis of rheumatoid spondylitis —John G Mayne.*]

Juvenile Rheumatoid Arthritis Challenges and Pitfalls in Diagnosis and Treatment are summarized by Robert D Gauchat[9] (State Univ of Iowa) Statistical data indicate that incidence of new cases of rheumatoid arthritis is probably about 2.7/100 000 children under age 15 This figure is comparable to incidence of the nephrotic syndrome among children (2.3/100 000 under age 10) and of juvenile diabetes mellitus (less than 2.8 new cases/100 000 under age 15)

High spiking fever unresponsive to therapy with salicylates and antibiotics is perhaps the most impressive clue to diagnosis A normocytic normochromic anemia is usually present that responds poorly to treatment with iron and vitamin supplements during active phases of the disease Moderate polymorphonuclear leukocytosis is common The erythrocyte sedimentation rate is rapid during periods of febrile activity Acute phase reactants such as C reactive protein serum mucoprotein and serum tyrosine are also present in high concentration and the total serum globulins are occasionally increased Elevation of the antistreptolysin O titer is unusual

Search for the so-called rheumatoid factor in the serum via the sheep cell agglutination test or the latex fixation test yielded *negative results in most* children studied The reason for this difference between juvenile and adult rheumatoid patients is unknown

By the time joint changes are visible roentgenographically and synovial tissue biopsies show the chronic inflammatory reaction consistent with rheumatoid arthritis diagnosis is usually obvious

Present knowledge offers no reliable prognostic clues to enable the physician to foresee a patient s future course Treatment is aimed at preservation of mobility and self sufficient independence insofar as this is medically possible maintenance of good nutritional status and promotion of

(9) Postgrad. Med 25.295-300 March, 1959

normal physical growth and support and encouragement of the patient's normal intellectual behavioral and social development in close cooperation with parents and appropriate social agencies

Short range goals include relief from pain modification of fever prevention of muscle weakness contractures and body ankylose avoidance of environmental experiences that may precipitate exacerbations such as intercurrent infections trauma and emotional upsets and avoidance of iatrogenic complications that may create more serious problems than those for which treatment was prescribed this being the most important goal of all

► [It is well to emphasize the nonspecific febrile illness which rheumatoid arthritis often presents in children. Juvenile rheumatoid arthritis will usually respond to salicylates in doses of 20 mg % and steroid treatment is often more difficult to control than to start. Chloroquine is available in 125-mg size.—John G Mayne.]

Pathogenesis of Rupture of Extensor Tendons at Wrist in Rheumatoid Arthritis George E Ehrlich Leonard T Peterson Leon Sokoloff and Joseph J Bunim[1] (Nat'l Inst of Health) observed 6 instances of a syndrome of rupture of



Fig 4 Left hand with ruptured 4th and 5th extensor tendons in man 60 Position of maximal extension of 4th and 5th fingers. Wrist is swollen, distal ulna prominent dorsally and carpus foreshortened. Bulge on dorsum of hand caused by bunched proximal stumps of extensor tendons to 4th and 5th fingers. (Courtesy of Ehrlich G E, et al Arthritis & Rheumat. 333-346, August 1959)

the digital extensor tendons in patients with rheumatoid arthritis of the wrists In each instance arthritic involvement at the distal radioulnar joint had led to subluxation and dorsal displacement of the ulna and approximation or even overlapping of the distal ulna and radius on the carpus (Figs

(1) A R 333-346, August 1959

47 and 48) This was accompanied by limitation of pronation and supination at the wrist The first awareness that the tendon had ruptured was the patient's observation that one of the fingers could not be extended In none of the patients could a history of even momentary pain be elicited After an interval of weeks to months a second tendon was disrupted



Fig 48 —Wrist showing disruption of distal radioulnar articulation in man, 60 There is destruction of bone in distal radius and ulna, particularly in proximal carpus. Ulna is subluxated dorsally and space between distal ulna and carpus is widened (Courtesy of Ehrlich (G. E., et al) Arthritis & Rheumat. 2 332-346, August 1959)

in the same manner as the first in orderly sequence first the extensors digiti quinti then the 4th 3d and 2d extensors (except in 1 patient in whom the extensor digiti quinti proprius was not involved presumably it lay in a deep groove on the radius and thus was spared) Finger extension was lost though the dorsal interosseous and lumbrical muscles sometimes permitted partial voluntary extensor response. The loose distal stump of the tendon was palpable at the metacarpophalangeal joint where it rolled freely under the examining fingers and ended abruptly just proximal to this

joint The proximal segment was palpable at the dorsum of the wrist or had retracted into the forearm Inspection of the hand against a source of light to emphasize shadows showed absence of the appropriate tendon in a location at the dorsum of the hand where the nonsevered tendons stood out sharply All the patients had some ulnar deviation of the hands No neurologic deficit could be demonstrated There was no constant relation between onset of rupture and duration of arthritis In 3 patients the tendon rupture followed by a few days to a few weeks the institution of physical therapy consisting of paraffin baths and exercises to increase range of motion of the hands and wrists In 1 patient rupture became apparent only a few hours after range of motion at the wrist joint had been tested

The tendons were repaired to protect the fingers from trauma and to restore extension The procedure used depended on the number of tendons ruptured

In the past few years many patients have been receiving effective physical therapy and antirheumatic agents These measures have achieved the desirable result of greater range of motion but thereby may have exposed the tendons to attrition

► [The pathogenesis of the tendon rupture in these cases was abrasion of the tendon over the roughened distal end of the ulna. This would emphasize the importance of early recognition and repair—factors neglected if one mistakenly attributes the tendon ruptures to rheumatoid lesions of the tendons themselves or tendon sheaths.—John G Mayne]

Spontaneous Dislocation of Atlantoaxial Articulation Occurring in Ankylosing Spondylitis and Rheumatoid Arthritis is evaluated by T L C Pratt.[7] The cause of spontaneous atlantoaxial dislocation is the same whether due to acute or chronic infection Hyperemia accompanying cervical infection results in decalcification of the atlas that may be sufficient to allow detachment of the transverse ligament. Finally the atlas glides forward over the superior articular surfaces of the axis with consequent flexion of the head

Histologic findings have been reported as replacement of bone marrow by fibrocollagenous tissue containing dense infiltrate of polymorphonuclear leukocytes lymphocytes occasional plasma cells and monocytes The rheumatoid condition thus involves extra articular bone as well as synovial tissue and other articular soft tissues From these

7 J Fac Radiologists 10 40 43 January 1959

pathologic processes it is noted that atlantoaxial dislocation must occur during an active phase of the disease

Acute neighboring infections cause sudden atlantoaxial dislocations with possible neurologic signs due to pressure of the odontoid process of the axis and posterior arch of the atlas on the spinal cord Sudden death may occur

The dislocation complicating chronic infection is a gradual process and Kornblum and others have suggested that serious spinal cord damage is rare for this reason

Pratt reports 2 cases of ankylosing spondylitis and 1 of rheumatoid arthritis complicated by atlantoaxial dislocation In 1 of the patients the reason for the atlantoaxial dislocation was not apparent at first though infection from the teeth before extraction was considered possible The first complaint of back pain occurred 2 years later and x rays confirmed the diagnosis of ankylosing spondylitis If x ray examination of the whole spine and the sacroiliac joints had been made when the patient first attended the hospital the diagnosis would probably have been apparent at that time despite the lack of relevant signs and symptoms

In another patient neurologic signs progressed rapidly after the discovery of atlantoaxial dislocation These were relieved immediately by neck traction

► [This condition is extremely interesting and can easily be missed even *with lateral views of the cervical spine unless it is specifically looked for* The current emphasis on peripheral neuritis in patients with rheumatoid arthritis particularly those receiving steroid therapy raises the danger that one may overlook other causes of neurologic deficit in patients with rheumatoid arthritis—including this very serious lesion —*John C Mayne*]

Little-Known X ray Sign in Spine in Ankylosing Spondylitis (Strümpell Marie-Bechterew) is described by K. Maier[3] (Univ of Frankfort) Ankylosing spondylitis is generally diagnosed only after stiffness is far advanced and the x rays show the classic changes in the iliosacral joint and on the vertebral bodies However onset of the disease has preceded these changes by many years All this time then has been lost and early treatment missed Early diagnosis is often difficult X ray studies may help in detecting the disease in its early stages

The x ray signs that have been considered typical of ankylosing spondylitis are involvement of the iliosacral joints osteoporosis of vertebral bodies and synostosis in interverte-

(3) Fortsch Geb. Röntgenstrahlen 89 331 338, September 1958

bral joints intervertebral disks and ligaments of the spine. The typical bamboo-stick appearance of the spine represents the end stage of the disease characterized by generalized ankylosing of the intervertebral joints including the interspinal ligament.

Relatively early in the disease, changes may occur in one or more vertebral bodies that can be demonstrated by x rays Two types of changes have been observed that may appear separately or combined angulation of the otherwise well rounded ventral margins of the vertebral bodies especially of the upper ones best noted in lateral views and straightening of the otherwise concave anterior wall of the vertebral body If both changes appear simultaneously the vertebral bodies present a typical "squaring

The author reviewed data on x ray findings in the spine in 53 patients with clinically proved ankylosing spondylitis The iliosacral joints were involved in all Squaring of vertebral bodies was noted in 49 patients involvement of small spiral joints in 42 whereas osteoporosis of the vertebral bodies was noted in 30 In some instances squaring of the vertebral bodies even preceded the changes at the iliosacral joints Thus squaring probably represents one of the earliest x ray signs

The clinical course has been divided into these stages (1) mobile stiffening of the spine (early involvement of the iliosacral joint, osteoporosis of the lumbar spine) (2) irreversible bony ankylosing of at least one segment of the spine (progressive ossification of the iliosacral joints, ossification of the annuli in the area of the lower thoracic and upper lumbar spine) (3) progressive bony ankylosing (bony bridges at the iliosacral joints ankylosing of two segments of the spine ossification of the costovertebral joints) and (4) end stage (bamboo spine osteoporosis ossification of costovertebral joints bony proliferation at the symphysis) Of the 49 patients who had squaring of the vertebral bodies 3 were classed as stage 1 16 as stage 2 26 as stage 3 and 4 as stage 4 Squaring in varying degrees isolated or generalized could be demonstrated in all stages The purest forms of squaring were found in stages 1 and 2 mostly among younger persons localized in all three segments of the spine Squaring was less pronounced in the cervical spine.

► [Squaring of the vertebral bodies has been a helpful suggestion but

hardly a diagnostic early finding in rheumatoid spondylitis. Withou cal sacroiliac joint changes or other objective changes it can onl port a suspicion of this diagnosis when the suspicion is already p —John G Mayne.]

Heredity in Ankylosing Spondylitis. Among 428 clos atives (parents brothers or sisters) of 70 patients wit kylosing spondylitis Daniel O Connell[4] (Charing Hosp London) found 14 males and 2 females with th ease The incidence of 1 case per 28 close relatives is greater than would be expected in the general popul (about 1 per 2 000) There can be little doubt therefore heredity is a factor in the disease.

In 6 instances the disease had been transmitted father to son This indicates that the transmission through a sex linked recessive as might be suggeste the preponderance of males because a sex linked gene mally cannot pass from father to son It is unlikely tha gene is a simple autosomal recessive. This would imply most cases of ankylosing spondylitis arise from cousin riages There was no evidence of consanguinity in this s

The genetic factor may be a simple dominant with d ing penetrance for males and females If it is assumed ankylosing spondylitis is an extreme form of rheumatoi thritis and if the cases of the two diseases are adde gether the ratio of affected relatives of the 70 patients primary cases becomes 14 males to 8 females This is significant deviation from equality There is evidence in a given family the same genetic factor that produce kylosing spondylitis in the male produces rheumatoi thritis in the female

The threshold for ankylosing spondylitis may be hi among females as is the case with gout

Hersh and co workers emphasized the increased li hood of complete penetrance of the heredity factor in fan with an affected female This seems to be borne out ir present group Of 36 close relatives of 7 females with mary cases and 2 with secondary cases 4 had ankyl spondylitis i e 1 in 9 instead of 1 in 28 as in the w series

There were 6 cases of rheumatoid arthritis among the close relatives of the 70 patients with ankylosing spon tis This incidence is two or three times that which w

(4) Ann. I t Med 50 1115-1121 May 1959

normally be expected but the numbers are not sufficiently large to be statistically significant

► [A hereditary factor in rheumatoid spondylitis has long been hypothesized. The relationship between rheumatoid arthritis and rheumatoid spondylitis is not known although current fashion tends to separate the two diseases. Certainly rheumatoid spondylitis can simulate rheumatoid arthritis, especially in the female. The family history given unfortunately does not prove that the sequence father (rheumatoid spondylitis) to daughter (rheumatoid arthritis) to grandson (rheumatoid spondylitis) could not really be rheumatoid spondylitis in all three generations —John G Mayne.]

Ankylosing Spondylitis in Women was studied by F Dudley Hart and K C Robinson[5] (Westminster Hosp London) in 30 patients. Age range at onset was 13 34 (average 22) which resembles the age at onset in males Only 1 patient

TABLE 1—Site of Initial Symptom in 30 Females

Site	Patients	
	No.	Per cent.
Lumbar spine and gluteal region	11	37
Lumbar spine and chest	7	23
Dorsal spine	3	10
Whole spine	2	7
Coccyx	1	3
Ischial tuberosity	1	3
Hip joint		7
Heel	1	3
Peripheral joints	1	3
Iritis	1	3
Total	30	99

TABLE 2—Extent of Sacroiliac Joint Involvement as Compared with Duration of Disease in 30 Patients

Duration of Disease (yrs)		0–4	5–9	10–14	15–19	20 and Over
Grade of Joint Involvement	I	2	2	1	0	2
	II	2	2	1	1	0
	III	1	1	1	0	1
	IV	0	2	6	1	4
Total		5	7	9	[illegible]	7

gave a history of ankylosing spondylitis in a relative. Site of onset is shown in Table 1 Pains described as affecting the region of the lumbar spine, sacroiliac joints and buttocks were not easily differentiated from one another As the condition progressed other sites were often involved and the cervical spine in particular was often affected.

The x ray changes in the sacroiliac joints were classified into four grades (1) ilial sclerosis with or without appar

(5) Ann. Rheumat. Dis. 18 15-23 March 1959

TABLE 3—SITE OF X-RAY ABNORMALITY IN 30 FEMALES WITH SPONDYLITIS

Site	Cases	
	No.	Per cent.
Sacro-iliac joints	30	100
Lumbar spine	1	40
[Lumbar spine bambooing]	[5]	[17]
Dorsal spine	9	30
Cervical spine	4	13
Hips		7
Symphysis pubis	7	23
Ischial tuberosity	3	10
Shoulders	one each	
Sterno-clavicular joints		
Knees		
Hands		
Feet		



Fig 49—Ankylosis of sacroiliac joints. Note line of "ghost" joints with residual "star" at top of obliterated joint (Courtesy of Hart F D, and Robinson, K C: Ann Rheumat Dis 18 15–3 March, 1959)

ent widening of the joint space loss of clarity slight erosions affecting less than half of one or both sides (2) more extensive erosions and ilial sclerosis (3) partial joint obliteration and (4) complete joint obliteration Changes in these joints showed an extremely variable rate of progress (Table 2) When fusion was complete the outline of the joint could be seen as a ghost joint at the upper end of which there was often a denser point of calcification the star sign (Fig 49)



Fig 50 —"Flared ribs," indicating fusion of rib to vertebral body (Courtesy of Hart F D., and Robinson K. C.: Ann. Rheumat. Dis. 18 15 23 March, 1959)

Sacroiliac involvement was present in every patient though occasionally the most advanced x ray changes were observed elsewhere, whereas there were still only early sacroiliac changes The second commonest part to be affected radiologically was the lumbar spine which was affected in 12 patients (Table 3)

X ray changes outside the sacroiliac joints were less common than among men Paravertebral calcification also was less common but it could develop within 5 years of onset of symptoms When the costovertebral joint was grossly involved it gave the appearance of a flared rib (Fig 50)

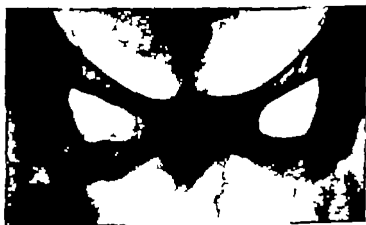


Fig 51—Widening erosion and sclerosis of symphysis pubis. (Courtesy of Hart, F D and Robinson K C Ann Rheumat Dis 18 15 23 March, 1959)

There did not appear to be an unduly frequent involvement of the cervical spine but lesions of the symphysis pubis were common (Fig 51) These consisted of erosions widening and sclerosis and were accompanied in 2 patients by local tenderness Painful lesions with x ray changes were also observed at sites away from articular structures.

Of the 30 study patients 20 were married and 14 had one or more pregnancies None noticed significant aggravation or improvement in the disease during pregnancy

► [The authors emphasize that severe deformity is less liable to develop in women with rheumatoid spondylitis than in men and more often than not the ankylosis in women is restricted to the pelvis.—John G Mayne.]

Osteotomy of Spine Formation of Wedge Vertebra in Hyperextension Gap Michael Burman[6] (Hosp for Joint Diseases New York) points out that two major skeletal events take place in the ankylosing spondylitis called Marie Strumpell disease fixation of the costovertebral joints which makes breathing shallow and abdominal and flexion deformity of the neck and spine (Fig 52) Two surgical procedures have been used indirect or bypassing extension osteotomy of the upper end of each femur which seems to straighten the back and direct osteotomy of the spine

(6) Radiology 73 104-106, July 1959

Definitive open osteotomy of the spine is usually done at a midlumbar level rarely in the neck or dorsal spine A large wedge of bone with posterior base is removed including the adjacent spinous processes the laminae and the fused apophysial joints When the coarse bone is resected care is

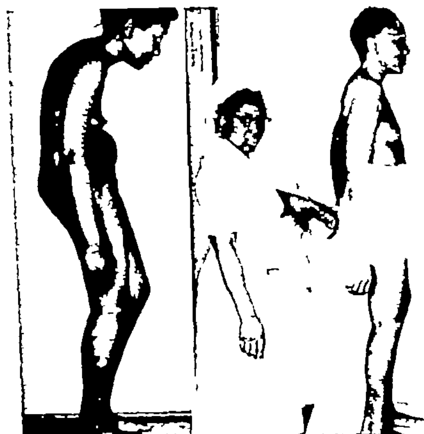


Fig 52 (left) —Preoperative appearance of woman, 36, who had osteotomy of spine 1 month later Technic of Adams was followed, with immediate manual correction of deformity by three-point pressure
Fig. 53 (right) —Same patient 1 year later some weeks after resection of left femoral head and neck and Schanz angulational osteotomy of femur (combined technic of Milch) Spine is straight. This operation was made necessary by continued pain in hip at rest, worsened by walking even with cane and difficulty in sitting
(Courtesy of Barman, M Radiology J 104-106, July 1959)

taken to spare the dura and the nerve root in the intervertebral foramen on either side

The operation may be done at one or more levels seldom more than two When carried out at one level the hinge point is the posterior part of the intervertebral disk. The upper vertebra tilts on the lower one Correction immediate or delayed is limited not by the size of the bone wedge that can be removed but by belly tension and the real possibility of



Fig 54 Lateral ray of lumbar spine day before surgery Well trabeculated wedge of bone fills hyperextension gap between 2d and 3d lumbar vertebrae (Courtesy of Herman M Radiology 3 104-106 July 1959)

paralytic ileus The hyperextension gap fills with blood and fragments of fibrous tissue It is not necessary to cut the bony anterior ligament as the spine is extended breaking of the ligament is indicated by a cracking sound Nor is it necessary to fuse the spine because the disease is by its nature self fusing unless there is a posterior gap that leaves dura bare On rare occasions later ossification in the hyperextension gap may create a new wedge vertebra as shown in Figure 54

Reiter's Syndrome Case Presentation and Review of Literature John I Kestel Jr (Waterloo Ia) John J Hanigan and A L Smith Jr[7] (Lincoln Neb) point out that the signs and symptoms of Reiter's syndrome consist primarily of conjunctivitis urethritis and arthritis of an abacterial nature The cause is unknown

(7) Nebraska M J 44 111 113 March, 1959

Youth, 18, had a brownish urethral discharge and burning sensation on urination He was given penicillin with no response. Two weeks later eye pain, photophobia and conjunctival discharge of a cloudy fluid developed He was then hospitalized Within the 1st week he had pain and swelling with effusion and limited motion of the knee and ankle joints Shortly after the arthritis began hemorrhagic red papular areas, 5 10 mm large appeared on the right ankle foot and soles of the feet. These soon appeared on the legs and a few on the abdomen The areas subsequently formed yellowish centers. Some coalesced and formed areas of hyperkeratosis.

On hospitalization urethral smears and cultures were negative except for two contaminants Cultures of the joint effusions were also negative. The VDRL test was negative. The white blood cell count was 7,700 erythrocyte sedimentation rate was 18 mm./hour The white blood cell count gradually rose to 14 000 He had low-grade fever of 99 101 F during the first few weeks At the end of a month his temperature reached 103 F every afternoon for 10 days and he was quite ill Blood cultures were negative. The sedimentation rate rose to 49 mm./hour Then the temperature began to subside.

Treatment had been symptomatic topical ophthalmic ointment containing steroids was applied to the eyes, and the conjunctivitis cleared fairly well within a month joint effusions when extensive were aspirated. Corticotropin and steroids helped the arthritis to some degree at first. The urethritis improved rapidly and recovery from this phase was fairly complete in 6 weeks

The arthritic pains and joint swellings persisted flexion and extension of the knee joints became limited and a fairly pronounced quadriceps atrophy developed. The rash had spread over the feet, legs hands and genitalia, with the characteristic lesions of keratodermia blenorrhagica.

With fever therapy physical therapy and salicylates the joint symptoms subsided in 3 months The keratodermia has been persistent. Baths, tar ointment and ultraviolet treatment were tried but furuncles developed, which were fairly well controlled by antibiotics Psoriasis-like lesions reappeared with the usual psoriasis therapy they are showing improvement.

Practical Importance of Synovial Fluid Analysis According to J George Furey William S Clark and Katherine L. Brine[8] (Western Reserve Univ) performance of three relatively simple laboratory procedures on synovial fluid greatly aids diagnosis of joint disease These tests are a total and differential leukocyte count evaluation of the quality of the mucin content by a method of acetic acid precipitation and determination of the difference between concentrations of the serum and synovial fluid sugar The tests have been described in a monograph by Ropes and Bauer who grouped most arthritides into two categories based on degree of in

(8) J Bone & Joint Surg 41 A:167 174 January 1959

flammation of the synovial membrane as reflected by the synovial fluid changes. Group 1, consisting of degenerative arthritis, neuropathic arthropathy and posttraumatic arthritis, is associated with mild inflammatory reactions and an increased amount of fluid but no significant change in the number of leukocytes, sugar concentration or quality of the mucin. Group 2 is characterized by more severe inflam-

TABLE 1.—Group 1 Result

Degenerative arthritis		19 cases
Mucin precipitate	Normal	11
	Fair	8
Leukocyte count	High	1,900
	Average	500
	Low	50
Polymorphonuclear neutrophil	Average	13%
Sugar difference	High	19 mg.
	Average	9 mg.
	Low	0
Traumatic arthritis		3 cases
Mucin precipitate	Normal	3
Leukocyte count	High	1,500
	Average	1,200
	Low	800
Polymorphonuclear neutrophil	Average	5%
Sugar difference	High	12 mg.
	Average	6 mg.
	Low	3 mg.
Neuropathic arthropathy		1 case
Mucin precipitate	Normal	
Leukocyte count		300
Polymorphonuclear neutrophil		38%
Sugar difference		15 mg.

mation of the synovial membrane and includes rheumatoid arthritis, gout and tuberculous and pyogenic arthritides. An intermediate group of unrelated conditions—systemic lupus erythematosus, pigmented villonodular synovitis and acute rheumatic fever—may have some distinguishing characteristics of the synovial fluid, but these are not usually diagnostic.

Results of the application of these tests in a group of 119 patients with diagnostic problems (Tables 1 and 2) compare favorably with identical studies by Ropes and Bauer. A sugar difference of 20 mg./100 ml. is the upper limit of normal and is characteristic of group 1 patients. A greater difference has

TABLE 2—GROUP 2 RESULTS

Rheumatoid arthritis		41 cases
Mucin precipitate	Normal	1
	Fair	9
	Poor	19
	Very poor	12
Leukocyte count	High	38,650
	Average	10 400
	Low	150
Polymorphonuclear neutrophils	Average	55%
Sugar difference	High	55 mg
	Average	22.5 mg
	Low	0 mg
Gout		3 cases
Mucin precipitate	Normal	1
	Fair	2
Leukocyte count	High	6,250
	Average	5 400
	Low	2 650
Polymorphonuclear neutrophils	Average	44%
Sugar difference	High	14 mg
	Average	12 mg.
	Low	10 mg
Tuberculous arthritis		2 cases
Mucin precipitate	Fair	2
Leukocyte count	High	58,300
	Low	42,200
Polymorphonuclear neutrophils	Average	88%
Sugar difference	High	40 mg
	Low	32 mg
Pyogenic arthritis		16 cases
Mucin precipitate	Normal	1
	Fair	3
	Poor	4
	Very poor	8
Leukocyte count	High	366,000
	Average	62,000
	Low	12,200
Polymorphonuclear neutrophils	Average	85%
Sugar difference	High	150 mg
	Average	50 mg
	Low	15 mg

been observed in rheumatoid arthritis of more than 6 months duration but has not been of the magnitude seen in infectious arthritis The leukocyte count is lowest in group 1 patients and highest in pyogenic arthritis Intermediate values are found in rheumatoid and tuberculous arthritis Trau

matic and degenerative arthritides are most often associ with a normal mucin precipitate whereas in rheumatoi thritis and the infectious arthritides poor or very poor cipitation is observed

► [Synovial fluid analysis although of interest in a large series, i seems helpful in the individual diagnostic problem unless history physical examination have strongly indicated the probable diagnosi the other hand, synovial fluid culture and especially culture and n scopic examination of tissue removed by punch or open biopsy are a real help Practical difficulty in fluid examination includes the necess preventing clot formation and of prompt laboratory studies on the —John G Mayne.]

Steroid Therapy in Rheumatoid Diseases is describe L Maxwell Lockie[9] (Univ of Buffalo) Corticotropin been used with uniformly satisfactory results in acute g arthritis About 40-60 units intramuscularly 2 or 3 tim day for several days or a single injection of 100-120 uni purified corticotropin gel or 20-40 units intravenously been effective The drug is given intravenously each over 6-8 hours This procedure should be followed by 0.5 colchicine twice daily for 10-14 days to prevent reb attacks

The earlier adrenal cortical steroids are given in r matic fever the greater is the possibility that they will b fective certainly not later than 3 weeks after onset of disease There is usually prompt suppression of the cli manifestations The drug should be given in gene amounts as long as this suppression is necessary The do should be varied depending on the activity of the rheum fever and stopped when the clinical manifestations subsided The greater benefit has been observed in the tient s cardiac status several years after the acute episo such an attack is treated early and with adequate doses cidence of rheumatic heart disease is lessened

Though osteoarthritis is not a rheumatoid disease a nal steroids when used intra articularly may be effe in relieving pain and swelling Oral administration of a nal steroids in osteoarthritis is of little or no value.

In collagen or connective tissue diseases adrenal ster are suppressive During acute episodes adrenal steroids definitely indicated and may be lifesaving

The patient with severe rheumatoid arthritis deserv trial with adrenal steroids Often great relief can be obta

(9) J A M A 170 1063 1066, June 27 1959

with small amounts The dose must be adjusted from time to time depending on the effectiveness of therapy

Patients who during the course of rheumatoid arthritis have severe constitutional signs of tachycardia, anemia fever and weight loss will need steroids in large amounts The steroids may save the lives of some of the patients Often these exacerbations are of short term perhaps several months after which the steroids may be discontinued

During gold therapy dermatitis develops in some patients Cessation of the gold salt medication will not improve the dermatitis Such patients will often derive great benefit when given an adrenal steroid to control the itching and irritation due to the dermatitis

One of the greatest uses of adrenal steroids is in the group in which a program of rehabilitation has been planned Intra articular use of steroids is important in many patients the action is more than suppressive because excellent responses may persist for long periods Range of motion is increased swelling recedes and pain is lessened Steroids should be administered intra articularly when one or two joints are more troublesome than the others

► [Proper use of steroids in rheumatic disease can be gratifying On the other hand, the uncontrolled use of these preparations can be disastrous. Colchicine alone or colchicine plus phenylbutazone or occasionally colchicine with the "delta" steroids (prednisone, prednisolone and triamcinolone and 6-methyl prednisone) are usually more satisfactory than the use of ACTH in the control of acute gouty arthritis.—John G Mayne.]

Joint Infections Following Steroid Therapy Roentgen Manifestations Roderick L. Toudreau Philip J Hodes and Erwin R. Schmidt Jr[1] (Hosp of Univ of Pennsylvania) report 17 cases of joint infection after steroid therapy Sixteen patients had received intra articular injections of hydrocortisone, 5 of whom had also received steroid systemically 1 had received oral steroids only In this patient pulmonary tuberculosis and tuberculosis of the hip developed

The knee joint was involved in 14 patients the shoulder in 1 the ankle and foot in 1 and the hip in 1 Onset of untoward symptoms usually occurred within 1 2 days after intra-articular injection Hemolytic Staphylococcus aureus was isolated in 11 patients Mycobacterium tuberculosis in 1 M tuberculosis and hemolytic Staph aureus in 1 hemolytic and nonhemolytic Staph albus in 1 nonhemolytic Staph al

(1) Am. J Roentgenol. 81:258 270 August, 1959

matic and degenerative arthritides are most often associated with a normal mucin precipitate whereas in rheumatoid arthritis and the infectious arthritides poor or very poor precipitation is observed

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The earlier adrenal cortical steroids are given in rheumatic fever the greater is the possibility that they will be effective certainly not later than 3 weeks after onset of the disease There is usually prompt suppression of the clinical manifestations The drug should be given in generous amounts as long as this suppression is necessary The dosage should be varied depending on the activity of the rheumatic fever and stopped when the clinical manifestations have subsided The greater benefit has been observed in the patient s cardiac status several years after the acute episode. If such an attack is treated early and with adequate doses incidence of rheumatic heart disease is lessened

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(9) J.A.M.A 170 1063 1066 June 27 1959

of prednisolone have been prepared triamcinolone (16-α hydroxy 9 α fluoro-prednisolone) Medrol (6-α methyl prednisolone) and Decadron (16-α methyl 9 α fluoro-prednisolone) The introduction of a halogen atom at the 9-α position of the steroid nucleus results in a general increase in potency of the compound This alone does not produce a useful drug because this compound results in marked sodium retention and potassium depletion When a hydroxy radical is added at

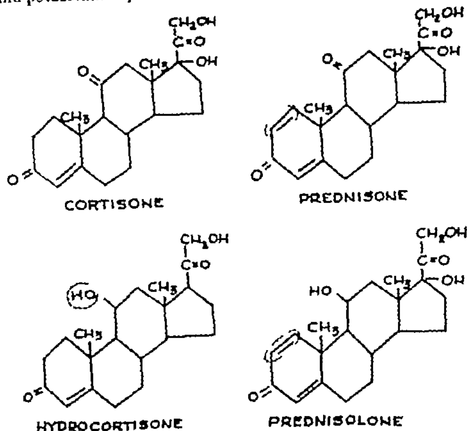


Fig 55 (Courtesy of Williams, G. T South. M. J 52:767 771, March, 1959)

the 16-carbon position as in triamcinolone (Fig 56), the electrolyte disturbances that would otherwise result are markedly decreased When a methyl rather than a hydroxy radical is added at the 16-carbon position (Decadron) the anti inflammatory effect is greatly enhanced and electrolyte effects are also decreased

Although electrolyte disturbances are uncommon with the newer preparations other side effects occur to some degree With higher dosage the incidence of side effects is greater The more bothersome adverse clinical effects are digestive

bus in 1 and Clostridium perfringens in 1 In 1 patient there was definite clinical evidence of infection but culture was negative

X-rays of 12 patients were available for review In 7 there was definite evidence of septic arthritis In 1 there was demineralization and possible bone destruction secondary to infection Soft tissue swelling was demonstrated in 1 patient who had superficial infection but no evidence of joint involvement In 2 patients the infection was brought under control before x ray changes appeared X rays on 2 patients were not available for review but these had been reported as showing evidence of septic arthritis The patient with tuberculosis of the hip showed destructive changes in the joint.

In 5 patients there were no sequelae after control of the infection Spontaneous fusion of the joint occurred in 2 patients and in 2 surgical fusion was subsequently performed. Two patients continued to have pronounced disability and 1 had restriction of motion secondary to septic arthritis One patient died of tuberculosis There was no follow up in 4 patients

In those who had intra articular injections alone it is doubtful that hydrocortisone had any effect on the spread of infection The infections more likely resulted from breeches of technic However it is likely that cortisone played a role in the development of infections when it had been administered systemically over long periods

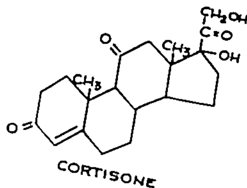
► [The author properly emphasizes the importance of sterile technic Even with these measures the risk of infection is definite, and intra articular steroids should not be used unless the benefit is known to outweigh the definite real risk —John G Mayne.]

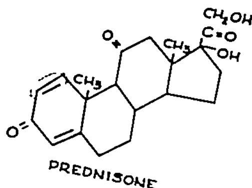
Comparative Evaluation of Newer Corticosteroids in Treatment of Rheumatoid Arthritis is presented by Guy T Williams[2] (Tulane Univ) With the introduction of prednisone and prednisolone in 1955 it was shown that the cortisone and hydrocortisone structures could be modified so as to increase the antirheumatic effects Prednisone and prednisolone differ from cortisone and hydrocortisone respectively only in having a double instead of a single bond between the 1 and 2-carbon positions of the steroid nucleu (Fig 55) This change increases the glucocorticoid and antiinflammatory effects and decreases electrolyte disturbance.

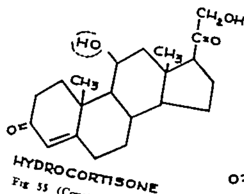
In the past 2 years three useful new synthetic derivatives

(2) South M J 52 267-273 March, 1959

of prednisolone have been prepared triamcinolone (16-α hydroxy 9 α fluoro-prednisolone) Medrol (6 α methyl prednisolone) and Decadron (16-α methyl 9-α fluoro-prednisolone) The introduction of a halogen atom at the 9-α position of the steroid nucleus results in a general increase in potency of the compound. This alone does not produce a useful drug because this compound results in marked sodium retention and potassium depletion When a hydroxy radical is added at







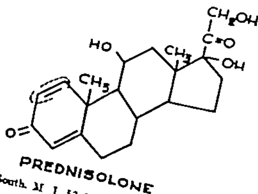


Fig 55 (Courtesy of Williams, G. T South. M J 52.267 273 March 1959)

the 16-carbon position as in triamcinolone (Fig 56) the electrolyte disturbances that would otherwise result are markedly decreased. When a methyl rather than a hydroxy radical is added at the 16-carbon position (Decadron) the anti inflammatory effect is greatly enhanced and electrolyte effects are also decreased

Although electrolyte disturbances are uncommon with the newer preparations other side effects occur to some degree With higher dosage the incidence of side effects is greater The more bothersome adverse clinical effects are digestive

bus in 1 and Clostridium perfringens in 1 In 1 patient there was definite clinical evidence of infection but culture was negative.

X rays of 12 patients were available for review In 7 there was definite evidence of septic arthritis In 1 there was demineralization and possible bone destruction secondary to infection Soft tissue swelling was demonstrated in 1 patient who had superficial infection, but no evidence of joint involvement In 2 patients the infection was brought under control before x ray changes appeared X rays on 2 patients were not available for review but these had been reported as showing evidence of septic arthritis The patient with tuberculosis of the hip showed destructive changes in the joint

In 5 patients there were no sequelae after control of the infection Spontaneous fusion of the joint occurred in 2 patients and in 2 surgical fusion was subsequently performed Two patients continued to have pronounced disability and 1 had restriction of motion secondary to septic arthritis One patient died of tuberculosis There was no follow up in 4 patients

In those who had intra articular injections alone, it is doubtful that hydrocortisone had any effect on the spread of infection The infections more likely resulted from breeches of technic However, it is likely that cortisone played a role in the development of infections when it had been administered systemically over long periods

► [The author properly emphasizes the importance of sterile technic. Even with these measures the risk of infection is definite, and intra articular steroids should not be used unless the benefit is known to outweigh the definite real risk.—John G Mayne.]

Comparative Evaluation of Newer Corticosteroids in Treatment of Rheumatoid Arthritis is presented by Guy T Williams[2] (Tulane Univ) With the introduction of prednisone and prednisolone in 1955 it was shown that the cortisone and hydrocortisone structures could be modified so as to increase the antirheumatic effects Prednisone and prednisolone differ from cortisone and hydrocortisone respectively only in having a double instead of a single bond between the 1 and 2-carbon positions of the steroid nucleus (Fig 55) This change increases the glucocorticoid and anti inflammatory effects and decreases electrolyte disturbance

In the past 2 years three useful new synthetic derivatives

(2) South. M J 52 267-273 March, 1959

of prednisolone have been prepared, triamcinolone (16-α hydroxy 9-α fluoro-prednisolone), Medrol (6 α methyl prednisolone) and Decadron (16-α methyl 9-α fluoro-prednisolone) The introduction of a halogen atom at the 9-α position of the steroid nucleus results in a general increase in potency of the compound This alone does not produce a useful drug because this compound results in marked sodium retention and potassium depletion When a hydroxy radical is added at

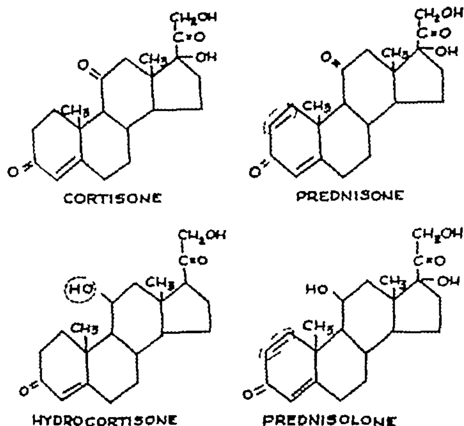


Fig. 55 (Courtesy of Williams, G. T South. M J 52:267-273, March, 1959)

the 16-carbon position as in triamcinolone (Fig 56) the electrolyte disturbances that would otherwise result are markedly decreased When a methyl rather than a hydroxy radical is added at the 16-carbon position (Decadron), the anti inflammatory effect is greatly enhanced and electrolyte effects are also decreased

Although electrolyte disturbances are uncommon with the newer preparations other side effects occur to some degree With higher dosage the incidence of side effects is greater The more bothersome adverse clinical effects are digestive

symptoms with or without peptic ulceration osteoporosis and muscle wasting ecchymoses psychic disturbances anorexia (triamcinolone) diabetes and sometimes erythema of the face

Hydrocortisone seems less likely to produce digestive symptoms than any of the synthetic derivatives to date. Though no one of the synthetic steroids is clearly superior to the others in this regard there is sometimes striking individual variation Some patients who tolerate one steroid poorly can take a different one without difficulty

Because of the variable effects on electrolyte metabolism

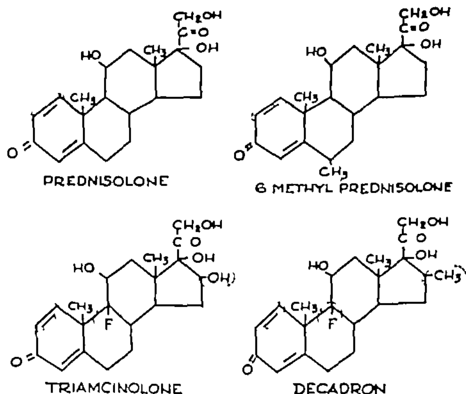


Fig 56. (Courtesy of Williams, C T South M J 5 67 3 March 1 59)

in some situations one steroid is more efficacious than another If the patient tends to have edema triamcinolone should be used If the patient is underweight triamcinolone probably should not be used because of appetite suppression On the other hand it may be helpful in the obese arthritic especially when there is associated chronic heart disease or psoriasis Since Decadron produces no appreciable effect on gluconeogenesis it should probably be used when the pa

tient is diabetic or for some other reason has impaired glucose metabolism

If none of these special circumstances applies comparatively equal antirheumatic effects can probably be achieved with each of the steroids In general 4-4 5 mg triamcinolone or Medrol is equal in potency to 5 mg prednisone. Although there is definite individual variation in general 0.75 mg Decadron is equal to about 5 mg prednisone.

Since therapy in rheumatoid arthritis must be prolonged and side effects tend to parallel dosage the dose should be reasonably safe for long term use. There is some debate as to what the maximum permissible dose should be, but in general it is advisable to hold the dose below the levels shown in the table.

MAXIMUM DAILY DOSE FOR LONG-TERM USE

	Prednisone	*6-methyl Prednisolone*	*Triamcinolone*	*Decadron*
Men	12 mg.	10	10	2.0
Women Premenopausal	10	8	8	1.5
Women Postmenopausal	8	6	6	1.1

► [It is well to re-emphasize the author's statement that except in very special circumstances comparatively equal antirheumatic effects can probably be achieved with each of the 7 steroids used in the treatment of rheumatoid arthritis and at approximately equivalent expense.—John G. Mayne]

Antimalarials in Treatment of Rheumatoid Arthritis were used in 5 patients by John B Catlett and Harold Dinsmore[3] (Richmond Va.) Three are in a state of remission but continue to take chloroquine regularly 1 still has pain and intermittent swelling but no fever and has continued to work since initial hospitalization in 1957, and 1 relapsed while taking chloroquine and is bedridden despite this therapy

Antimalarials have been used increasingly in treatment of rheumatoid arthritis since 1951 Primaquine an 8-aminoquinilone derivative, is too toxic for practical use. Atabrine and chloroquine are 4-aminoquinilones Atabrine has proved toxic, occasionally causing agranulocytosis or exfoliative dermatitis This drug has largely been replaced by chloroquine. No serious reactions to chloroquine have been reported though the drug occasionally causes multiform skin

(3) Virginia M. Month. 86:217 220 April, 1959

rashes blurring of vision a seasickness type of syndrome or gastrointestinal disturbances The gastrointestinal disturbances, though not serious may necessitate discontinuing the drug The authors observed increased blood pressure in 2 patients Hydroxychloroquine (Plaquenil) has antirheumatic effects similar to those of chloroquine and may be less toxic

Chloroquine is usually given in 250 mg capsules or enteric-coated tablets once a day A favorable response is noted in 3 weeks to 3 months but occasionally may not occur for 6-12 months In the latent period other therapy such as aspirin Butazolidin or small doses of cortisone may be used for the initial response

► [The antimalarials are a new family of medicine which have followed the steroids, gold salts and butazolidin in the attack on rheumatoid arthritis Like these other preparations they must be used with caution.—John G. Mayne.]

Relationship of Trauma to Arthritis was studied by William J Tobin[4] (Washington D C) so that the physician insurance adjusters and the legal counselors involved may have a clearer understanding of the underlying changes that occur in the various types of arthritis Osteophytosis is due to degenerative changes that occur in the intervertebral spaces with resulting bridging between the vertebral bodies causing loss of normal elasticity of the ligaments As degenerative changes progress concomitant degeneration occurs in the articular facets the small joints of the spine wherein degenerative osteoarthritic changes do develop *Joints involved by arthritis would most likely not respond* to trauma as would a normal joint It is the consensus that trauma is not a significant etiologic factor in development of rheumatoid arthritis An injury to a spine with pre-existing rheumatoid spondylitis may well aggravate symptoms over many months

Any fracture near to or into the articular surface of a joint may result in osteoarthritic degenerative changes developing within the joint Even though the fracture may not involve the joint but be adjacent to it the result in some degree however little, of a malunion the resulting malalignment of corresponding surfaces constituting the joint is conducive to the development of osteoarthritic changes A fracture of the proximal end of the tibia, though united but

(4) Am S rgeon 25 332-343 May 1959

in malposition, resulting in a knock knee or bowleg deformity might constitute the mechanical basis for the subsequent development of degenerative changes in the knee

Fractures of the patella even though repaired by open reduction and internal fixation may result in a roughening of the undersurface of the patella and be a significant factor in the development of osteoarthritis of the knee At times patellectomy is preferable to attempted repair of the fractured patella because of the inability to bring about a smooth alignment of the undersurface of the patella.

The dashboard type of injury which presents the usual clinical picture of a posterior hip dislocation associated with fracture of the acetabulum may result in a latent type of degenerative arthritis

► [An extremely interesting paper discussing an aspect of arthritis in which decisions are too often made on emotional rather than factual bases by physicians as well as by patients. This paper should be read in its entirety —John G Mayne.]

Nature and Treatment of Osteoarthritis were studied by C H Hembrow[5] (Melbourne) The essential changes in osteoarthritis are painless Many people submitted to x ray examination show radiologic evidence of unsuspected and advanced osteoarthritis There are osteophytes, changes in the adjacent bone and most important of all loss of joint spaces These x ray changes took at least 10 years to appear but the patient had not noticed pain or other symptoms during that time.

The pain does not arise from the osteoarthritic process but is associated with the appearance of complications and tissue reactions and in only a small percentage of patients do these develop Though aging cannot be prevented the complications of osteoarthritis are in many instances remediable.

The painful complications may be mechanical inflammatory or due to changes in the adjacent bone Examples of mechanical failure are seizing due to an irregular articular surface the mechanical effects of osteophytes nipping of villi and fringes formation of loose bodies and limitation of range by adhesions The symptoms are usually sudden in onset and are produced by activity and relieved by rest The pain is due to local pressure or to stretching of fibrous tissue adhesions or normal ligaments Symptoms of chronic inflamma

(5) M J Australia 2 833-835 Dec 20 1958

tion are worse on arising in the morning and the joint feels stiff and sore. Activity improves and the joint may even move freely, but the pain returns as the day goes on in the form of an ache that persists for an hour or so after the patient has retired These symptoms suggest the effects of periarticular edema accompanying the inflammatory state. Symptoms due to changes in the adjacent bone arise from the effects of associated circulatory conditions such as arteriosclerosis hyperemia sclerosis or cystic changes occur and by irrita tion of the nerves in the haversian canals give rise to a con tinuous ache unaffected by activity or rest.

The objective in treatment is relief from pain and to a lesser extent from deformity and stiffness Activity and rest must be taken on the little and often" principle to aid the *patients in preserving as normal a mode of life as possible.* Complete rest encourages stiffness overactivity brings strain The patient can often in this way find a regimen that *considerably reduces the discomfort at once. Light full* range movements are carried out once a day for a few min utes This procedure helps to preserve the range In patients with inflammatory disease active and passive exercises and manipulation under anesthesia may be required after infec tion and toxemia have been excluded or corrected

► [Degenerative joint changes are extremely common and almost invariably present to some degree in middle-aged or older persons. There fore, it is well to have emphasized the fact that osteophytosis seen by x ray is usually not a causative factor nor is it frequently an adequate explanation of back pain. Any explanation of these changes which cursorily terms them "arthritis of the back can produce much anxiety— John G Mayne]

Osteoarthrosis and Disk Degeneration in Urban Population. In a population sample of 380 persons aged 55-64 J H Kellgren and J S Lawrence[6] found x ray evidence of osteoarthrosis in 83% of the males and 87% of the females Disk degeneration was observed in 83% of the males and 72% of the females

The distal interphalangeal joints of the fingers and the 1st metatarsophalangeal joints of the feet were most com monly affected in both sexes Females had far more osteoarthrosis in the distal and proximal interphalangeal joints of the fingers in the 1st carpometacarpal joints and in the metatarsophalangeal joints Males had more involvement

(6) Ann Rheumat D 17 388 397 1958

of the wrists and hips The knees and sacroiliac joints were more often involved in females Osteoarthrosis of multiple joints was seen more often in women than in men

Osteoarthrosis was seen at the site of an injury in 35% of males and 15% of females In both sexes the knees most often showed this association Few females had traumatic osteoarthrosis at any other site In males the lumbar spine was frequently involved often in conjunction with disk degeneration

Among males 74 miners and 18 cotton workers had more osteoarthrosis than 81 men in other occupations In miners the lumbar spine and knees were significantly more affected but the most striking feature was the excess of lumbar disk degeneration In cotton workers the small joints of the hands and the cervical spine were more often affected In females domestic work was the predominant occupation However no significant differences were found in the pattern of osteoarthrosis among housewives and those working outside the home.

In both sexes the metatarsophalangeal joint of the great toe was more commonly affected by osteoarthrosis in the obese The knee was affected more than twice as often in obese females and somewhat more often in obese males The lumbar spine was more commonly affected by osteoarthrosis in obese males

A clear association between Heberden s nodes and multiple osteoarthrosis was demonstrated in both sexes but especially in females

Hydrocortisone in Osteoarthritis C P Tiwari and P N Bhargava[7] treated 80 patients (Table 1) who had osteoarthritis with intra articular hydrocortisone

Technic.—The joints were approached from the most superficial point from which the needle could enter the synovial cavity by the shortest route and without endangering any important structures. The usual aseptic precautions used for aspiration were adopted as a routine. Aspiration of even a drop of fluid confirmed the position of the needle in the joint. The hydrocortisone used contained 25 mg /cc. The amount of hydrocortisone used for each joint was determined arbitrarily After an injection the joint was moved gently through its full range of movements and a firm bandage or preferably a crepe bandage was applied for 24 hours. The latter precaution diminished the chances of reactionary effusion and post injection pain.

(7) Indian J Surg 1 21 26, February 1959

TABLE 1—Type of Osteoarthritis in 80 Patients

Joint Treated	No. of Patients	%
Knee	45 (Unilateral 27) (Bilateral 18)	56.25
Ankle	10	12.50
Wrist	8	10.00
Shoulders	8	10.00
Hips	3	3.75
Interphalangeal	6	7.50
Total	80	100.00

TABLE 2.—Period of Relief after Intra articular Hydrocortisone Therapy

Joint	Period of Relief
Knee	Minimum — 10 days
	Maximum — over a year
	Average — 8 weeks
Ankle	Minimum — 8 days
	Maximum — 3 months
	Average — 3 weeks
Shoulder	Minimum — 1 week
	Maximum — 4 months
	Average — 3 weeks
Wrist	Minimum — 2 weeks
	Maximum — about a year
	Average — 3 months
Hip	Minimum — 1 week
	Maximum — 5 weeks
	Average — 3 weeks
Interphalangeal joint	Minimum — 2 weeks
	Maximum — 4 weeks
	Average — 3 weeks

The period of relief varied from 1 week to more than 1 year (Table 2) In most of the patients relief remained for 3-6 weeks The period of relief also seemed to depend on the amount of the patient s activity Early recurrence of pain was noticed when patients abused the limbs or indulged in excessive use of the joint. The relationship was so evident that the patients often forecasted pain recurrence before a possible bout of excessive activity There was no tolerance to the drug Each time the same dose gave relief for similar periods if the limb was not abused.

An optimum quantity of drug was required to produce clinical relief in each individual joint and increase in dosage beyond this did not increase the period and/or amount of relief

Ten patients with knee joint disease who had relief after

the first injection were given weekly injections of 25 mg hydrocortisone for 6 weeks The period of relief shown in Table 3 varied from 3 weeks to over 6 months This would suggest that a weekly prolonged therapy is not likely to produce more lasting results There was no relation between severity of radiologic findings and amount of relief after intra articular therapy

Increase in local pain sometimes extremely disturbing to

TABLE 3—PERIOD OF RELIEF AFTER 6 WEEKLY INTRA ARTICULAR INJECTIONS OF HYDROCORTISONE IN 10 KNEES

PERIOD OF RELIEF	NO. OF PATIENTS	%
3- 6 weeks	2	20
6-12 weeks	2	20
12 24 weeks	3	30
Over 6 months	3	30

the patients was noticed 8-10 hours after injection in 52 patients This was accompanied by warmth and local tenderness in 34 patients and with small effusion in 9 When therapy was successful pain subsided within 24 hours and was followed by demonstrable improvement in symptoms and signs as compared with the preinjection state. Successive injections in the same joint usually produced lesser reaction

► [Intra articular steroid therapy relieves acute flares of osteoarthritis which usually follow trauma or overuse. The symptomatic relief usually persists only if full conservative measures of protection, rest, support and physical medicine are used. One should condemn the frequent use of intra articular steroid therapy with the purpose of encouraging or allowing excessive use of damaged joints. Osteoarthritis of the shoulder and ankle are sufficiently rare (unless posttraumatic) as to raise questions regarding the diagnosis when these joints form 18 of 80 (22%) in a series.—John G. Mayne.]

Surgical Treatment of Cervical Osteoarthritis is described by Robert W Rand and Paul H Crandall[8] (Univ of California Los Angeles) Early results of anterior cervical intervertebral disk excision and fusion (Cloward operation) together with removal of associated arthritic bone spurs pressing on nerves and the spinal cord give promise of relief from pain and muscle weakness in patients who have this form of cervical osteoarthritis.

Results among 47 patients reported by Cloward were gratifying 42 had complete relief from the neck shoulder and arm pains and 5 had partial relief Recovery was more

(8) California Med. 91:185 188, October 1959

rapid after the operation than that which occurs after cervical laminectomy

The authors experience with the operation was not as good as Cloward's Fourteen patients were treated 6 of whom had primarily a root compression syndrome 2 root and cord compression and 6 cord compression The 6 with more local disease and symptoms of root compression only had immediate and complete relief One man aged 43 had severe right arm pain for 3 months and on x ray examination a severe osteophyte formation at between the 5th and 6th cervical vertebrae caused a transverse defect in the myelogram This defect was corrected by the anterior disk removal and interbody fusion and the patient had solid bony fusion 3 months after operation with continued relief from symptoms One patient had some return of arm pain in his case the foramen was only partially widened

Among patients with root pain and cord compression with chronic myelopathy there was good relief from pain but only mild improvement of myelopathic symptoms—primarily flexor spasms In the less chronic myelopathic problems 1 patient with a Brown Sequard syndrome had almost complete relief in 48-72 hours The reason for the poor response in chronic myelopathic disease was irreversible intrinsic ischemic changes in the cord.

Pseudoarthrosis occurred in 2% of the patients in Cloward s series which now numbers 84 cases The authors did not encounter this complication Unless the dowel is countersunk slightly it may come out necessitating replacement The chances of damaging the nerve roots and spinal cord are of prime concern By carefully using the specialized instruments designed for the operation there is less chance of such damage than in the usual formal cervical laminectomy

All patients with severe neck shoulder and arm pain syndrome and those with signs of spinal cord disease should be carefully screened for presence of the cervical spondylosis form of osteoarthritis

Lesions of Joints and Tendon Sheaths in Systemic Lupus Erythematosus were studied by Bruce Cruickshank[9] (Glasgow) Tissue was examined from 14 joints of 10 patients and from palmar tendon sheaths of 7 patients who had

(9) Ann. Rheumat. Dis. 18 111 119 June, 1959

systemic lupus erythematosus All but 1 had shown clinical evidence of arthritis In 2 pain and swelling of the joints was the initial symptom followed in a few weeks by other symptoms including the characteristic rash In the other patients evidence of lesions elsewhere had accompanied or preceded the arthritis The clinical features were pain and swelling involving several joints most commonly those of the hands and wrists Permanent damage characterized by ulnar deviation of the fingers with subluxation of the metacarpophalangeal joints was observed once

At autopsy most joints showed only minimal changes such as small effusions and congestion of the synovial tissue Early pannus was noted on the femoral condyles in 2 knees and in another knee there was definite acute synovitis No macroscopic abnormality was detected in the tendon sheaths

All but 1 of the 14 joints examined showed histologic changes The most constant feature in the synovial tissue was a thick layer of brightly eosinophilic fibrin like material on or under the surface This material merged with the adjacent synovium and often contained pyknotic nuclei It was noted in 11 joints The main change in the synovial cells was a diminution in their number These two changes were often combined so that the eosinophilic material lay directly on the subsynovial tissue Hematoxylin bodies distinct from pyknotic nuclei were found in 11 joints Inflammation was slight or absent.

The articular cartilage was damaged in 5 of 6 finger joints In 3 there was marginal erosion with a thin layer of granulation tissue on the surface of the cartilage or on the subchondral bone plate where the cartilage had disappeared. Minimal inflammation was noted in the immediately adjacent bone

Fibrin like material was present on or beneath the surface of the tendon sheaths in 6 of the 7 patients investigated Frank necrosis was not noted Hematoxylin bodies were noted in 5 patients and were distributed among the synovial cell nuclei on the surface and the inflammatory cells beneath the surface Inflammation was more pronounced than in the joints

► [As our concept of systemic lupus erythematosus has expanded, similarities between this disease and many cases of rheumatoid arthritis have

been increasingly evident At times it is not possible to classify certain diseases as being wholely one or the other Among the similarities to be emphasized is the appearance of destructive joint lesions and tenosynovitis in patients with systemic lupus erythematosus.—John G Mayne.]

Diagnosis of Gout Significance of Elevated Serum Uric Acid Value Joel C Goldthwait Carrol F Butler and J Sydney Stillman[1] (Boston) reviewed the records of 225 patients with serum uric acid values greater than 6 mg/100 ml. Diagnosis of gout was made in 113 patients Of these 78 gave the classic history of this disease—acute recurrent attacks of arthritis with asymptomatic intervals Nine additional patients were seen in the initial attack of gout. In 26 diagnosis of gout was made but the pattern of symptomatology and physical abnormalities was not typical

The other 112 patients had some well-defined entity other than gout or nonspecific symptomatology and findings not susceptible to accurate diagnosis Of this group without gout 63 had typical or atypical rheumatoid arthritis or psoriasis

Kidney disease is a possible explanation for elevated serum uric acid values in patients with no evidence of gout or rheumatoid arthritis However only 2 of these patients had avowed kidney disease. All determinations of nonprotein nitrogen in the others were normal or not persistently elevated

About 6-8% of patients with polycythemia have clinical gout and the association of hyperuricemia and polycythemia vera has long been known Though no cases of true polycythemia were encountered in this series 33 patients showed hematocrit levels above the upper limit of normal, i e above 45% In only 1 patient was the hematocrit elevation associated with a persistently elevated white cell count, and in none was splenomegaly found In addition no patients were observed with neoplastic diseases of the bone marrow as a possible explanation for their hyperuricemia

Several writers have emphasized the fact that elevated serum uric acid levels occur in nongouty relatives of gouty patients Positive family histories were obtained in 6 of the 112 patients with no clinical evidence of gout.

Various authors have found that serum uric acid values greater than 6 mg/100 ml are present not uncommonly in the general population Presumably then the random oc-

(1) New England J Med 259 1095 1099 Dec. 4 1958

currence of hyperuricemia in the general population would explain the elevated uric acid serum levels in some of the patients in this study.

Aside from continued observation there is no easy method for arriving at a diagnosis in the atypical case suspected of being gout. Occasionally the difficulty of differentiating the rheumatoid nodule from the gouty tophus will arise and in this situation a biopsy is helpful. Inspection and biopsy of the joint in some atypical cases might give the answer but this is obviously not a practical procedure. Needle biopsy has been performed in the suprapatellar pouch of the knee and could possibly have limited use. Apparently there have been no studies of this problem using isotope tagged uric acid or uric acid precursors. In some cases an approach from the opposite viewpoint might be helpful, viz. the use of various agglutination tests for diagnosis of rheumatoid arthritis. If this diagnosis could be made with reasonable assurance by some laboratory procedure, the physician presented with the atypical case would be much more secure from the viewpoint of therapy and prognosis.

► [The hazards of basing a diagnosis on the result of a single laboratory test should be well known, and gout is an excellent example. It has been shown that more than 20% of blood relatives of patients with gout may have elevated serum uric acid values and many of these will never show objective evidences of gout. The true range of "normal" values of serum uric acid concentration in the general population is still not completely known. The diagnosis of gout remains a clinical one to be supported by evidence of elevated serum uric acid value but not to depend on this finding.—John G. Mayne.]

Alkaptonuria and Ochronosis were studied by Jan Cervenansky, Stefan Sitaj and Tibor Urbanek[2] (Bratislava, Czechoslovakia) in 22 families who exhibited hereditary alkaptonuria. The disease was present in 119 individual members; of these 36 (22 men) had ochronotic arthropathy.

The basic biochemical abnormality is in the metabolism of tyrosine, which normally is transaminated to p-oxyphenylpyruvic acid, which then probably is further oxidized to 2,5 dioxyphenylpyruvic (homogentisic acid.)

Each newly discovered patient with alkaptonuria in the authors' series afforded an opportunity for the discovery of new cases in the patient's family. Because all the families affected came from mountainous areas and from small villages in which endemic goiter was shown to be prevalent, it may

(2) J. Bone & Joint Surg. 41-A:1169-1182, October 1959.

be of interest to point out that tyrosine is the precursor not only of homogentisic acid but also of thyroxin The clinical picture in man may be manifested by no other symptoms than excretion of homogentisic acid This single symptom may go on for decades before other symptoms supervene. The symptoms are due to deposition of the homogentisic acid derivatives in many tissues which then turn black or brown and thus give rise to the term ochronosis Ochronotic pigment is assumed to be caused by oxidation and polymerization of homogentisic acid probably via the enzyme tyrosinase The ochronotic pigment is deposited in connective tissues in granules mainly perivascularly in macrophages but also extracellularly and to a smaller degree in parenchymal cells

Average duration of symptoms in the 36 patients with arthropathy was 12 years varying from 1 to 34 years The first joint symptoms were in the spine. There was an indefinite sensation of stiffness in the lumbosacral region accompanied by some pain but never so intense as that which occurs in inflammatory conditions Though progression of the disease with age was often noted the pain did not necessarily increase proportionately to the advance of the pathologic changes in the spine In some patients ankylosis with complete rigidity was accompanied by only minimal pain

► [The joint lesions of ochronosis as seen by x ray are primarily those of severe degenerative joint disease. Calcification of multiple intervertebral disks strongly suggests this diagnosis.—John G Mayne.]

Degenerative Arthritis of Lumbosacral Joint End-Space Lesion. Of 222 patients examined for degenerative arthritis of the vertebral column John C Wilson Jr [3] (Los Angeles) found the lumbosacral joint involved in 160 and the other lumbar joints in only 62 A study was made of 125 patients with lumbosacral arthritis Most had initial symptoms before age 40 Only 14 gave a history of real trauma or heavy lifting Among 11 treated after industrial injuries x rays showed pre existing lumbosacral arthritis in 10 Included in the study were members of 10 families in whom there was definite evidence of a hereditary tendency toward degeneration of the lumbosacral joint

Duration of symptoms before the initial examination varied from 1 to 40 years Regardless of whether onset was acute

(3) J.A.M A 169 1437 1442, M 28 1959

or chronic progress of lumbosacral arthritis was characterized by recurrent low back pain with or without sciatic radiation Attacks occurred at intervals of several weeks to several months and tended to increase in severity Usually acute pain came on during simple movements such as bending forward to wash the hands or make a bed However episodes of intense pain were often preceded by a period of physical exertion fatigue emotional upset or respiratory infection

By far the commonest chronic symptom was stiffness of the lower back on arising in the morning Other chronic symptoms were backache with prolonged sitting pain in

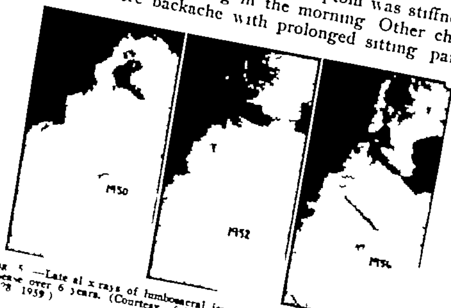


Fig 5 —Lateral x rays of lumbosacral joint of women 43 showing progression of disease over 6 years. (Courtesy of Wilson, J C., Jr J.A.M.A. 169 1437 1442, Ma 28 1959)

the lower back on arising from a sitting posture backache with prolonged standing and with physical exercise Occasionally lumbosacral pain was felt over the coccyx over one or both sacroiliac joints in the buttocks in the lower abdominal quadrants or in the groin

Diagnosis of lumbosacral arthritis can be strongly suspected from the history and physical findings but accurate diagnosis depends on adequate x rays In view of the slowly progressive nature of the disease serial x rays are sometimes needed (Fig 57) before diagnosis is confirmed.

In the present group patients with acute symptoms were treated conservatively with bed rest anodynes and physical therapy They usually had relief from pain in 3-7 days In

the chronic phase the wearing of a Goldthwait brace often gave remarkable relief from pain Lumbosacral fusion was performed in 42 patients Complete relief from pain and recovery of motion was achieved in 18 Symptoms were relieved in 17 except for occasional mild back or leg ache, usually after exertion Thus lumbosacral fusion gave relief from acute and chronic symptoms in 83% of the patients These have not all been followed for long periods and no prophecy can be made as to their future complaints Further backache may occur because 131 movable joints remain above *the area of fusion However response to operation by these* patients taken as a group was far better than that among patients subjected to so-called disk surgery alone.

Side Effects Following Triamcinolone P Hume Kendall and Maurice F Hart[4] report clinical progress and side effects in 47 patients with rheumatoid arthritis treated continuously for 5-11 months Almost all were severely disabled with overwhelming disease unable to work and confined to home with little interest in life. Most had been treated with prednisone or cortisone and were changed to triamcinolone because of diminishing clinical response to increasing dosage or because of the appearance of side effects

Of the 47 patients who began treatment with triamcinolone 36 are still maintained on the drug Of the 11 taken off 7 had rapidly become worse and 4 had severe side effects Six of these are well maintained on prednisolone and 2 on 6-methyl prednisolone and 3 have taken no further steroids.

Altogether 24 patients had side effects the commonest being facial and body flushing (17) The facial appearance was typical distinct from that usually associated with high dosage of the other steroids The skin of the whole face from hairline to neck appeared to be involved becoming a uniform bright pink Moonface was observed in 9 2 of whom had marked hirsutism within 6-8 weeks of starting treatment Eight had dyspepsia and 1 had hematemesis and melena within 24 hours of the first symptoms of dyspepsia. Four were mentally depressed Two had spontaneous fractures Severe weight loss—more than 14 lb—occurred in 5 and 4 showed rapid symmetrical muscle wasting

The 36 patients are still well maintained and continue treatment despite minor side effects in a few In relation

(4) Brit M J 1 682 685 M 14 1959

to its potency in arthritis there appears to be little difference between triamcinolone and other available steroids particularly if high dosages are required

The most significant finding was the relative lack of complications with doses of 6 mg triamcinolone or less daily Only 3 of 23 patients on this dose had any discomfort Clinical results have been good The response is considered much greater than that which follows the equivalent dose of prednisone and prednisolone Therapy with triamcinolone is now started with 4 mg daily and increased to 6 mg if necessary but greater doses are avoided if possible This is considered the highest level at which therapy can be safely prolonged

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FRACTURES DISLOCATIONS AND SPRAINS

Early Care of Patient with Multiple Fractures is described by Sherman S Coleman[5] (Univ of Utah) Initial evaluation of the patient must include critical appraisal of his general condition which is best accomplished by the team approach Except for life threatening hemorrhage from major arterial damage to the extremities fracture care per se takes low priority Even in open fractures definitive orthopedic care must await treatment of more urgent injuries involving the head thorax and abdomen Diagnostic x ray studies of the extremities are contraindicated until it is deemed safe to proceed with definitive fracture care During the early period of total patient evaluation splinting of fractures can be easily accomplished without x rays

Maintaining an adequate airway is all important. If indicated tracheotomy should be performed without hesitation Analgesics and narcotics for control of pain are often essential to prevent aggravation of shock For minor head injuries when the patient is conscious Demerol or codeine may be given However each patient must be critically individualized when there are severe head injuries Administration of morphine should be avoided in all instances because of its miotic effect which deprives the surgeon of helpful aid in evaluating head injuries

The average patient with multiple fractures loses about

(5) Am J Surg 97 43-48 January 1959

1 800 cc circulating blood whether the fractures are open or closed Replacement therapy must be started at once, especially if the patient is in shock or if shock is impending Transfusion should be given selectively to others according to calculated loss particularly to those for whom surgery is contemplated

The possibility of severe renal dysfunction is always present after serious trauma particularly among the aged those with pre-existing renal disease and those with extensive injury to the soft tissues This problem should be handled by a member of the diagnostic and therapeutic team experienced in treatment of kidney failure and electrolyte imbalance.

Broad spectrum antibiotics are indicated when there are open wounds A tetanus toxoid booster or tetanus antitoxin should be given as indicated

After resuscitation and general supportive therapy it is the responsibility of the fracture surgeon to thoroughly examine the patient s musculoskeletal system Indications for specific x ray examination are determined by local physical findings but common sense dictates that all regions suggesting trauma be studied by x ray

As soon as the patient s condition permits all open wounds must be treated as emergencies Thorough debridement and cleansing are essential whether the wounds are closed primarily or secondarily will vary with the local problem as well as with the individual surgeon

In otherwise normal persons metabolic disturbances are rarely of clinical consequence early in the treatment of multiple fractures However diabetics and those on steroid therapy may present special problems

Conservative Treatment of Fractures is advocated by William T Fitts Jr[6] (Univ of Pennsylvania) To select the truly conservative treatment many factors must be weighed including the relative importance of function to the patient the surgeon s skill operating room facilities anesthesia nursing personnel and incidence of pathogenic bacteria.

A shattered elbow may justify operation and internal fixation in a young laborer but not in a woman aged 80 Surgeons may underestimate the primacy of time and function to the patient in their concern with preventing death or life-endangering complications

(6) Am J Surg 9 253-254 March 1959.

Conservative treatment for a specific fracture may be open operation in the hands of a Clay Ray Murray but balanced skeletal traction suspension for the author The surgeon who does not have a completely equipped operating room available must have imperative reasons for operating on a fracture. Patients with fractures are often difficult anesthetic problems Many are hospitalized with full stomachs In determining the conservative treatment for a specific fracture the physician must weight the quality of anesthesia which is available

Russell traction produces excellent results in some hospitals for the treatment of trochanteric hip fractures To be effective Russell traction needs an intelligent specially trained and enthusiastic nursing staff on the fracture service

If infection with Staphylococcus aureus is rampant in a hospital open operation may not be conservative for any fracture. Conservative treatment is not static it changes from week to week and from hospital to hospital

Fractures of Hip D C W Finney Beverley B Jones and George O Eaton[1] (Union Mem'l Hosp Baltimore) present a follow up study on 315 patients treated surgically for hip fracture The in hospital survival rate was 93 9% Of 134 patients in good general health 3 died of 136 with compensated chronic disease 8 died and of 48 with uncompensated chronic disease 8 died. All who died were over age 60 Pneumonia was the cause of death in 7 patients pulmonary emboli in 3 myocardial infarction in 3 unknown cause in 3 cerebral vascular accidents in 2 and hypertensive cardiovascular disease in 1

General anesthesia was used in 94% of the patients There were no anesthetic deaths or complications attributable to anesthesia

Complications occurred in 28% of the patients urinary tract infection in 16 decubitus ulcers in 12 displacement of fracture during hospitalization in 11 pulmonary embolus and wound infection in 10 each congestive failure in 9 pneumonia in 8 and phlebitis in 4 There were 21 other complications of less frequent occurrence

Of the entire group 81% survived more than 1 year after discharge Follow up of 276 patients showed that bony union had occurred in 95% of those with intertrochanteric frac

(1) Am Surgeon 25 8-11 January 1959

tures in 91% with impacted neck fractures and in 78% with displaced neck fractures

Of 64 patients with displaced neck fractures treated with Jewett nails 13 failed to obtain bony union The Pugh nail has been used increasingly since 1956 Of 11 patients treated with Pugh nails none has shown nonunion Best results in treatment of displaced neck fractures occurred among patients with minimal time interval between the fracture and surgery

Early Weight Bearing in Treatment of Fractured Neck of Femur A H G Murley[8] (Royal Nat'l Orthopaedic Hosp., London) reports results in treatment of 41 patients Internal fixation with a trifin nail was performed by 16 surgeons. Postoperatively the patients were encouraged to sit in chairs within the first 2 days and to begin partial weight bearing on crutches as soon as pain from the operative wound had subsided In most cases partial weight bearing with crutches started 10-19 days after surgery and the patient returned home walking with the aid of crutches, 5-6 weeks after operation A decision to allow unguarded weight bearing was made most often 3-6 months after operation after clinical examination and study of serial films

Union occurred in 70% of all those treated and in 84% of those still living at the time of follow up 1 2 years postoperatively The percentage showing union is similar to that reported in similar groups of elderly patients who were kept off their feet much longer The proportion could doubtless be increased with this method by individual surgeons of greater experience and possibly by the more efficient immobilization afforded by a sliding nail plate. The figures indicate however that early weight bearing does little harm and it is of great value in maintaining patient morale and preventing disuse osteoporosis and weakness

Life Expectancy after Fracture of Hip William T Fitts, Jr Herndon B Lehr Stanley Schor and Brooke Roberts[9] (Univ of Pennsylvania) collected follow up data on 108 patients with 109 fractures of the hip until death or for a minimum of 4 years after fracture. On the basis of associated diseases the patients were divided into three broad groups. Group I included patients with mild or no associated disease

(8) Lancet 1 24-25 Jan. 3 1959
(9) Surg Gynec & Obst. 108 7 12, January 1959

group II those with moderately severe associated disease e g significant arteriosclerosis pulmonary emphysema compensated heart failure and old myocardial infarction and group III patients with severe associated diseases e g recent myocardial infarction, renal failure, uncompensated congestive heart failure and metastatic cancer

All but 12 fractures were treated by internal fixation (Table 1) A Smith Petersen nail was used for intracapsular fractures and either a Neufeld blade plate or a Smith Petersen nail fixed to a McLaughlin bar for trochanteric fractures In the first part of the study a few trochanteric frac-

TABLE 1—SUMMARY OF PATIENT CHARACTERISTICS BY LOCATION OF HIP FRACTURES

Characteristics*	Location of Fracture		
	Neck	Trochanteric	All
Mean age, yr	69 9	72.6	71.5
Males, %	9	22	17
Group III associated disease, %	22	27	25
Mean time between fractures and operation, days	2.7	2.9	2.8
Pinned, %	93	86	89
General anesthesia (for patients pinned) %	74	86	80
Postoperative complications, %	31	52	43
No of fractures	45	64	109

* No characteristic yields difference between trochanteric and neck cases at 0.05 level of significance

tures were treated by Roger Anderson well-leg traction One badly comminuted trochanteric fracture was treated by balanced skeletal traction suspension

Three femoral neck fractures were impacted in the position of abduction and were treated by forbiddance of weight bearing only

Local anesthesia was used in 2% of patients spinal in 17% and general in 71% Patients with trochanteric fractures usually received 1 000 ml whole blood before and during operation and patients with intracapsular fractures usually received 500 ml Treatment with antibiotics was begun immediately after admission Heparin was used for prophylaxis of pulmonary embolism. Patients were helped out of bed and into a chair each day beginning the day after operation When the patient was strong enough ambulation with crutches or a walker was permitted but weight bearing was

forbidden on the injured side until the fracture was thought to be solidly healed

Hospital mortality compared with that reported in the literature, was reasonably low 6.5% but mortality before weight bearing was considerably higher 26% Hospital mortality for the trochanteric group was more than 4 times that for the neck of femur groups—9 4 and 2.2% respectively During the first 6 months 34% of patients with trochanteric fractures and only 13% of those with neck of femur

TABLE 2.—Effect of Various Characteristics on Mortality before Weight Bearing

	Died before Weight Bearing	Survived	Total	Significance at 0 05 Level
Mean age yr	75.7	70 1	71.5	Yes
Mean time between fracture and operation, days	3 6	2 6	2.8	Yes
Mean operation time, min.	117	121	120	No
Group III associated diseases %	46	17	25	Yes
General anesthesia %	86	69	72	No

fractures died The authors feel that the 6 months mortality is a much more realistic figure than the hospital mortality for comparison of results of various therapeutic methods

Average time from injury to treatment was 2.8 days (Table 2) For patients who died before weight bearing the average time from injury to treatment was 3 6 days but for those who lived to bear weight this time was 2 6 days The difference is significant The mean age (75.7) of patients dying before weight bearing was significantly higher than that (70 1) of patients surviving The percentage in group III was significantly higher for patients dying before weight bearing than for those surviving this period

Comparison of the life expectancy of patients after fracture with that of a group similar in age sex and race showed that after the first 6 months the life expectancy of fracture patients is not appreciably less than that of the general population which is about 11 years Because so many patients have a long life expectancy the authors question the advisability of using a second best method e.g the prosthetic femoral head in all patients with femoral neck fractures especially those who are in relatively good general condition The general condition of the patient may be a bet

ter criterion for or against use of the prosthetic head than an arbitrary age e g 75 years

Intracapsular Fracture of Hip Use of Substitution Femoral Head Prosthesis in Primary Treatment of 15 patients with average age of 79 is evaluated by Lester W Carlander[1] (Minneapolis) Average postoperative hospital stay was 15 days all were ambulant to some degree with assistance.

TECHNIC.—The operation consisted of a lateral approach to the hip with the patient lying on the opposite side, a release of about the anterior one third to one half of the gluteal medius and minimus attachment to the trochanter anterior arthrotomy of the hip then dislocating the hip anteriorly The head was removed from the acetabulum and the ligamenta teres or any other soft tissue at the base of the acetabulum was removed. The neck was prepared for the prosthesis and the prosthesis of proper size inserted checked to see that it fitted well then reduced into the acetabulum The hip was tested while the capsule was open to make sure that external rotation would not easily dislocate the hip again The capsule was closed, muscles reattached to the trochanter and the wounds closed In all patients, an Austin Moore intramedullary prosthesis was used. This is a metal prosthesis cast from Vitallium, with fenestration in the shaft portion through which subsequent bony growth may give further stabilization. Anesthesia consisted of spinal block.

Two of the patients died during postoperative convalescence There were no postoperative infections nor dislocations of the prosthesis Postoperatively the patients were not immobilized They were up in a chair within the first few days and were allowed to walk with support by the end of the week Ambulation is easier in some disoriented patients with an assistant helping on each side

Hip reconstruction by insertion of a femoral head prosthesis in primary treatment of an intracapsular fracture is indicated in patients of very advanced age in whom early ambulation is made possible and some degree of independence during their remaining life in patients who are somewhat disoriented or incapable of full cooperation and in those who because of age general feebleness impaired vision or impaired use of extremities such as after cerebral vascular accidents will be unable to use crutches effectively without weight bearing for 4-6 months postoperatively The author is somewhat more inclined to use a femoral head prosthesis in fractures that are of the extreme subcapital type

► [The value of insertion of a femoral head prosthesis for rehabilitating aged patients who suffer a fracture of the femoral neck is, I believe in

(1) Minnesota Med 42 566-570 May 1959

disputable. By making these patients ambulatory many complications may be avoided and nursing care reduced to a minimum.—Ed.]

Fractures of Femoral Neck in Children may be complicated by a faulty position which tends to become aggravated through weight bearing, according to Pekka Peltokallio and M Kurkipää[2] (Jyväskylä Finland) These fractures can be classified as epiphysial (Fig 58) transcervical cervicotrochanteric (Fig 59 and 60) and intertrochanteric In the epiphysial type the fracture is in the epiphysial line of the femoral head It is a traumatic detachment of a formerly



Fig 58.—Epiphysial fracture of femoral neck in boy 2, with displacement of femoral head. (Courtesy of Peltokallio, P and Kurkipää, M Ann chir et gynaec. Fenniae 48 151 163 1959)

normal epiphysis The head of the femur may even become dislocated from the articular socket In the transcervical type, the fracture line crosses the center of the femoral neck In the cervicotrochanteric type the fracture line is in the base of the femoral neck a so-called hinge fracture In the intertrochanteric type the fracture line runs through the trochanters

Among 6 children with fracture of the femoral neck due to severe trauma epiphysial fracture was the commonest.

Reposition with operation was carried out in 2 patients in whom the femoral head was displaced from its articular socket It was followed by traction therapy during 2-3

(2) Ann chir et gynaec. Fenniae 48 151 163 1959

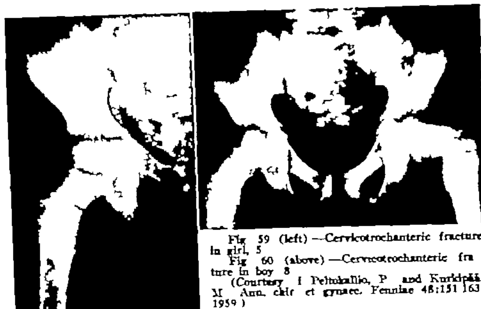


Fig 59 (left) —Cervicotrochanteric fracture in girl, 5

Fig 60 (above) —Cervicotrochanteric fracture in boy 8

(Courtesy I Peltokallio, P and Kurkipää, M Ann. chir et gynaec. Fenniae 48:151 163 1959)

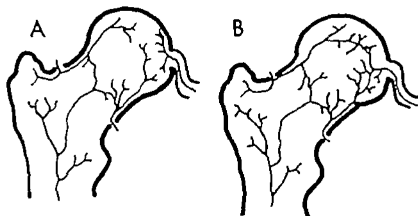


Fig 61 —*A* In children, foveolar artery of ligamentum teres does not penetrate cartilage of femoral head, but branches out like glove in small ramifications into immediate neighborhood of fovea centralis. *B* In adults, foveolar artery usually penetrates femoral head, reaching as far as center of ossification and anastomosing with capsula vessels. (Courtesy of Peltokallio, P., and Kurkipää, M. Ann. chir et gynaec. Fenniae 48 151 163 1959)

months and 2 months without weight bearing No ossification occurred in either patient the final result being necrosis of the caput and a poor result. In 4 patients treatment was conservative tibial traction during 6 weeks and a plaster support during another 6 weeks with weight bearing allowed 3 months after the accident In 2 slight coxa vara occurred but the functional result was good in all.

The femoral head is less well vascularized in children than

COMPLICATIONS IN DIFFERENT STATISTICS COLLECTED ON FEMORAL NECK FRACTURES AMONG CHILDREN

	Number of Cases	Caput Necrosis	Non-union	Mal position	Good[1] Result	
Own statistics 1958	6	2	—	—	4	
Mitchell v 1938	10	—	1	4	3	2 omitted
Wilson v 1940	10	2	(1)	6	2	1 control time too short
Carell v 1941	10	4	1	4	6	
Allende v 1951	8	2	1	3	3	1 control time too short
Ingram v 1953	24	6	3	2	11	7 control time too short
Streicher v 1957	5	2	—	—	3	

[1]Result before osteotomy good primary result. Often two complications developed in same patient

in adults because the foveolar artery of the ligamentum teres does not penetrate the cartilage of the femoral head but branches out like a glove in small ramifications into the immediate neighborhood of the fovea centralis (Fig 61 *A* and *B*) Anastomoses gradually develop between ages 12 and 14 This anatomic difference accounts for the many capitular necroses among children and their occurrence in fractures of the trochanteric region as well as the relatively slow recovery from these fractures

Complications of femoral neck fractures among children as observed by various authors are listed in the table.

Pelvic Support Osteotomy for Certain Fracture Complications of Hip Failure of a hip prosthesis can be disastrous because a major portion of the head and neck of the femur must be removed to make way for it and little may be left for salvage In such a serious situation James K Stack and Konstantine George[3] (Chicago) suggest that consideration be given to resection angulation osteotomy The indications for use of this procedure must be individualized and will be found in instances in which arthrodesis or other types of arthroplasty are not indicated or have failed Resection angulation osteotomy has given favorable results in selected cases i e in arthrodesis in certain ununited fractures of the femoral neck with absorption of the neck and avascular necrosis of the head and in long standing cases of congenital dislocation of the hip The authors believe that the indica

(3) Am. J Surg. 97 644-648 May 1959

tions may also include certain cases in which hips have been replaced by stem prostheses and the end result has been a failure.

In principle the site of osteotomy for pelvic support is determined by the relationship of the femur to the acetabulum It is selected so that transection of the bone and the remaining distal fragment fall under the acetabulum thereby restoring a line of weight bearing This renders the hip more stable and at the same time the femur proximal to the osteotomy acts as a lever for the function of the pelvifemoral muscles All deformities present at the time of the operation (adduction flexion and rotation) may be corrected by this method. The site of osteotomy long a controversial point can simply be selected at a level where the osteotomy angle will come under the acetabulum Improvement results from correction of deformities and mostly from the stability obtained by bringing the femur under the acetabulum

The procedure consists of resection of the head and neck and creation of an angulation abduction deformity at the appropriate level in the femoral shaft In those instances in which a prosthesis has failed it is resected followed by osteotomy The site of osteotomy and the degree of the postosteotomy angle will determine the deviation of the mechanical axis and effective length of the limb It is on these features that the functional result will depend.

In this era of the hip prosthesis the author considers it desirable to kindle interest in this old operation to meet a new need

► [One of the drawbacks to treating a hip with a femoral head prosthesis is the fact that in many instances the bridge is burned behind the surgeon for doing anything further should the prosthesis not work out satisfactorily The pelvic support ostectomy may fill the gap Certainly more experience should be gained with this procedure, and indeed what actually happens with this operation is that one transforms the shaft of the femur into a type of Bachelor operation which has in certain instances proved to be of value.—Ed.]

Comminuted Fractures of Acetabulum Central Dislocation of Femoral Head Arthur Holstein and Gwilym B Lewis[4] (Berkeley Calif) devised a modification of the Jahss turnbuckle procedure for treatment of comminuted acetabular fracture with central dislocation of the femoral head.

METHOD —Bilateral long leg plasters are applied from high on the groin to the tip of the toes These plasters must be well padded along

(4) J Internat Coll Surgeons 32 65-70 July 1959

the entire length of the medial and lateral aspects of the leg The heels must be carefully protected by a cut-out of felt, so that direct pressure over the os calcis is prevented. Sponge rubber for padding is to be avoided, since this tends to keep the skin moist and allow maceration. When these plasters are dry a block of wood with a small wedged indentation cut into each end, 6×4×1½ in is placed between the upper medial aspects of the plasters thereby placing the legs in wide abduction. At the ankles a piece of light rubber tubing of the type used for infusions is placed around both plasters, drawn moderately

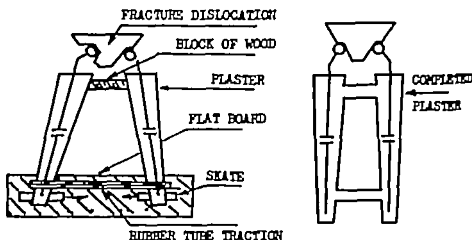


Fig. 62 (left) —Method of reduction.
Fig 63 (right) —Final immobilization.
(Courtesy of Holstein, A. and Lewis, G B.: J Internat. Coll. Surgeons 32 65-70 July 1959)

taut and tied or held by a heavy Kocher clamp. Excessive tension on the rubber should be avoided, since the leverage effect is excellent. To prevent friction between the plasters and the bed a board should be placed transversely in the bed and the plasters rested on a pair of roller skates with the wheels parallel to the rubber tubing This allows for the full effect of the medial traction. If these rollers are not readily available, each leg plaster may be suspended by a rope to the overhead frame, thereby securing the same unopposed effect (Fig 62) After reduction has been obtained the upper block of wood is incorporated into the leg plasters, and a cross bar attached at the ankle level replaces the tubing This converts the apparatus into a fixed plaster that includes the well leg thereby holding the pelvic fracture and the reduced dislocation in the desired position for healing (Fig 63)

The authors used this technic in 5 patients aged 22-67 Earlier weight bearing is an advantage of this method. Long term results showed some limitations primarily in internal and external rotation but subjectively the results were satisfactory the patients reported good function with no limp Only 1 patient had stiffness and aching after prolonged activity

► [Central dislocations of the femoral head and fractures of the acetabulum present a challenging problem. The method described by the authors is unique and can be used in certain instances particularly when there is unilateral involvement and the bones of the legs are intact. Too often patients with this type of fracture have other injuries of the legs and this method cannot be successfully utilized. It is, however, a method to keep in mind for treatment in specific instances.—Ed.]

Bucket Handle Tear of Acetabular Labrum Accompanying Posterior Dislocation of Hip Thomas B Dameron Jr[5] (Raleigh N C) reports a case

Man 30 sustained a posterior hip dislocation in an automobile accident. The usual clunking sound was not heard as the femoral head was replaced in the acetabulum under spinal anesthesia. The hip was relatively unstable and redislocated when flexed to 45 degrees. X rays after manipulation revealed that the joint space was wider on the affected side Soft-tissue interposition was suspected. At operation the cartilaginous acetabular labrum was found within the joint. It was pulled out to normal position and sewn to the bone with chromic catgut sutures After this, the hip was stable and recovery was uneventful.

When a femoral head dislocates posteriorly it must go through a defect in the capsule between the cartilaginous labrum and the acetabulum or through the bony posterior portion of the acetabulum When the labrum is separated from the acetabulum by the femoral head it may be displaced in a manner similar to a bucket handle tear in a knee meniscus If the femoral head brings the torn cartilage ahead of it into the acetabulum as it is being reduced surgery is necessary

A tear of the acetabular labrum with interposition after reduction of posterior dislocation should be suspected when (1) the femoral head does not clunk into the acetabulum at time of reduction (2) the hip is unstable after manipulation even though there is no fracture and (3) pelvic x rays show a wider joint space on the affected side

Dameron believes that the strong acetabular labrum has an important function and should be reattached to the acetabulum if possible

Pathologic Fractures of Hip Mihran O Tachdjian Clinton L Compere and Philip H Davis[6] studied 32 pathologic hip fractures in 30 patients aged 46-70 The primary aims of treatment should be reduction of pain early ambulation or mobilization of the patient with simplification of nursing care maintenance of physiologic balances and facilitation of specific therapy for the primary or secondary lesions The

(5) J Bone & Joint Surg 41-A:131 134, January 1959
(6) Surg Gynec. & Obst. 109 13-26 July 1959

economic saving is often of great importance Each patient must receive individual evaluation

In the authors patients, conservative and operative treatments were used Conservative treatment consisted of bed rest only in 3 terminal patients in whom fracture fragments were displaced slightly or impacted skin traction the method of Buck or Russell in 7 skeletal traction through the distal portion of the femur in 1 and well leg traction in 2 Operative treatment consisted of prophylactic nailing and plating in 1 patient nailing and plating in 3 primary replacement prosthesis of the femoral head in 1 and insertion of a long McLaughlin nail through the trochanter and neck and head of the femur into the thickened portion of the ilium above the acetabulum in 1

Well leg traction is indicated in the treatment of patients whose hips are so destroyed by the metastatic lesions that internal fixation or primary replacement prosthesis is not feasible and in those who are almost terminal and cannot tolerate major surgery Well leg traction should be applied with heavy Steinmann pins through both distal femurs and the pins incorporated in the casts The method relieves pain allows early use of the wheel chair and permits simple home nursing care. It affords adequate immobilization for inter and subtrochanteric fractures The patient is surprisingly active and comfortable and the fractures often heal in satisfactory position

Operative treatment has its limitations and risks These patients are debilitated by the neoplastic process The danger of distant spread of tumors by direct or embolic means is another argument against surgery Nitrogen mustard has been used recently to prevent spread of live tumor cells during and after cancer surgery it is certainly of value for palliation of pain and when properly administered its toxicity has not been serious

Dashboard Femoral Fracture Pathomechanics, Treatment and Prevention. Femoral shaft fracture is peculiar to the driver or front seat passenger of an automobile traveling at high speed During a head-on collision the front seat occupant continues directly forward and the knee region strikes the instrument panel or floorboard. If the passenger's hip is adducted the femoral head is well out of the acetabulum and posterior dislocation of the hip results from the im

pact (Fig 64) This is the usual injury to the female passenger who habitually rides in automobiles with the hips adducted The usual posture of the male is that of wide hip abduction with the femoral head well seated in the acetabulum and with the greater trochanter riding almost against the ilium posteroinferiorly (Fig 65) With the hip in abduction dislocation cannot occur and femoral fracture results

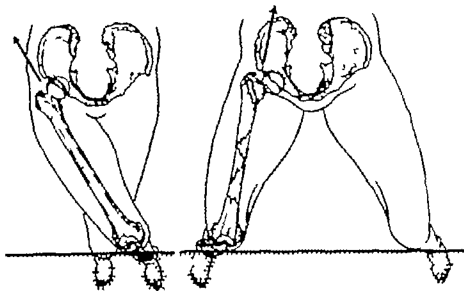


Fig. 64 (left) —Posture of hip in adduction. Dislocation results on longitudinal force application to femur

Fig. 65 (right) —Posture of hip in abduction. Femoral head cannot escape from acetabulum and femoral fracture may occur

(Courtesy of Ritchey S. J., *et al.* J Bone & Joint Surg 40-A 1347 1358, December 1958.)

The fracture is due to instantaneous longitudinal compression of the femoral shaft by extraordinary force causing structural failure of the shaft over a long area, with extreme fracture comminution Associated acetabular or femoral neck fracture may be sustained

Of 30 typical dashboard femoral fractures in males observed by Sterling J Ritchey George J Schonholtz and Milton S Thompson[7] (Walter Reed Army Med Center), 12 resulted from head-on collision with another moving vehicle and 17 from impact with fixed roadside objects (trees telephone poles bridges or grade abutments) In 1 the impact object was unknown All 30 patients had moderately to severely comminuted fractures of the femoral shaft. Ipsilateral knee injury occurred in 24 (80%) and hip injury in 6

( ) J Bone & Joint Surg. 40-A 1347 1358, December 1958.

Femoral shaft fracture is best managed conservatively in skeletal traction with constant supervision to prevent femoral shortening. Open surgical treatment of associated ligament tears of the knee and femoral neck fractures is recommended. Despite the magnitude of injury in comminuted shaft fractures, favorable results can be anticipated with conservative management.

Proper construction of the instrument panel and installation of seat belts to allow controlled deceleration on impact are feasible and economical safety measures useful in preventing dashboard femoral fractures. Removal of roadside impact objects, construction of widely separated dual highways and planting of low roadside shrubbery are recommended to reduce the number of head-on collisions.

Problem of Supracondylar Fracture of Femur in the Aged Person. The supracondylar fracture in the aged is usually sustained in the female with a markedly decalcified femur



Fig. 64.—Supracondylar fracture with posterior displacement of distal fragment. Skeletal traction applied to tibial tubercle, and posterior angulation corrected by sling under fracture site. (Courtesy of Wade, P. A., and Okinaka, A. J.: Am. J. Surg. 97: 499-512, April, 1959.)

and as a rule is due to a minor fall. These fractures result from unnatural leverage applied in the supracondylar area due to a predisposing knee or joint disability or, in many instances, to disability of both joints.

Any treatment which may permit early ambulation is de-

sirable Preston A. Wade and Arthur J Okinaka[8] (New York) use internal fixation by intramedullary rods, angle plates and bolts whenever possible to allow the patient to be ambulatory These methods sometimes seem heroic but they are often lifesaving Because of the fragility of the fractured fragments, it is sometimes difficult to maintain reduction by internal fixation, and the operative procedure therefore fails

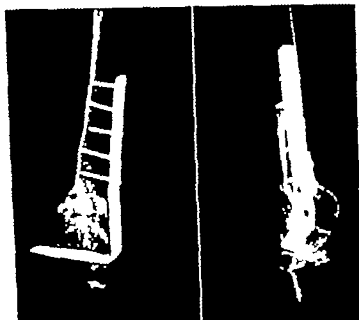


Fig 67—Supracondylar fracture in woman aged 85 after fixation by Blount plate with resulting limitation of motion of knee joint. (Courtesy of Wade, P A. and Okinaka, A. J Am. J Surg. 97 499 512, April, 1959)

to achieve early ambulation If in the surgeon s judgment, operation must be followed by plaster immobilization then the surgery may not be justified

In many supracondylar fractures in the aged displacement of the fragments is not great particularly if there has been pre-existing stiffness or ankylosis of the knee joint In cases in which the knee joint is already stiffened it is unnecessary to consider the joint in treatment of the fracture and immobilization in plaster is usually the best method These fractures usually heal well

Skeletal traction by wire or a pin through the tibial tubercle with the limb suspended in a Thomas splint or Böhler frame (Fig 66) is the treatment of choice in many instances. The authors believe that the Austin Moore type of plate or

(8) Am J Surg 97 499 512 April, 1959

the modified Blount blade plate (Fig 67) are the most effective in holding the usual supracondylar fracture in position.

► [Supracondylar fractures in the aged present a problem to the orthopedic surgeon. Although the traction method has proved beneficial, there are some extenuating circumstances that lead one to use an operative approach with internal fixation. It is obvious from the authors presentation that no one method can be applied to all these fractures At times the blade plate fixation serves the purpose better whereas in some instances transfixion screws or other methods of internal fixation have their place. When the fracture is badly comminuted and intra-articular one may have to elect a bone graft as a *primary procedure, crossing the knee joint* and including an arthrodesis of the knee or immobilization of the fracture. Needless to say each case must be judged on its own merits—Ed.]

Blade-Plate Internal Fixation of Supracondylar Fractures of Femur By extending the principles and advantages of open reduction and internal fixation to supracondylar fractures of the femur several surgeons have noted that a blade-plate can be useful Earl P Holt Jr [9] (St Louis) reports its use in 25 supracondylar fractures in 23 consecutive patients (average age 58) An average of 8 days elapsed between injury and operation

TECHNIC.—The patient is placed in a supine position To maintain neutral rotation of the thigh a folded sheet or flat sandbag is placed under the hip To relax the pull of the gastrocnemius the leg rest of the table is dropped about 20 degrees. A pneumatic tourniquet may be used high on the thigh The leg is draped free. With adequate anesthesia, skeletal pin traction is unnecessary A true lateral skin incision which may be extended downward to curve below the patella, through which the lateral expansion of the quadriceps and the patellar ligament may be divided, provides complete access to all fragments and makes exact reduction of the articular surfaces of the condyles relatively simple.

The fracture zone of the distal femur is exposed by separating the vastus lateralis from the biceps and from the lateral intermuscular septum The blade-plate is shaped with bending irons to fit the side of the femur Through a slot created by drill holes, the blade is driven into the cancellous bone of the condyles When the condyles are separated, temporary fixation in reduction with a pin or screw will facilitate transfixion with the blade In placing the blade-plate, varus, valgus or recurvatum angulation should be avoided. If indicated, the position of the nail and fragments should be checked by anteroposterior and lateral x rays in the operative field.

When protection of the assembly seems indicated postoperative management should include a long leg plaster cast If fixation is adequate, a simple dressing may be used with balanced suspension with active and passive exercises. Drill of the quadriceps muscle is begun early and non-weight bearing ambulation with crutches is frequently permissible. Weight bearing is deferred until clinical and roentgenologic union are obtained.

(9) South. M J 52 1331 1336 November 1959

In 6 of the 25 fractures the patellar ligament was divided with no increase in problems of postoperative management or later complications Protective leg casts were used in 17 of the 23 patients (19 fractures) for periods varying from 2 weeks to 5 months An effort was made to reduce such fixation to a minimum

Technic of Enlarging Bone Marrow Cavity Medullary nailing may fail because the thin nail is not strong enough and may break or bend The free space around the nail in the medullary cavity may be too large to permit adequate immobilization of the fracture fragments In some instances the medullary cavity may be too narrow to permit use of a strong enough nail In order to use a heavy nail G Küntscher[1] (Hamburg) widens the bone marrow cavity The drill used not only removes the entire contents of the bone marrow cavity but also removes the endosteum and a considerable part of the compacta This generous widening of the medullary canal is used not only in the treatment of pseudoarthroses and in almost all osteotomies but also in 20-30% of all fresh fractures Experience in several hundred patients has shown that this radical procedure is harmless even if only a thin layer of compacta with its periosteum remains The full thickness of the remaining bone wall is fast restored. This also holds for the forearm which is usually slow in callus formation

Widening of the medullary canal also severs the nutrient artery but this has not led to severe hemorrhages Actually the bleeding was always minimal and stopped by itself In any routine of medullary nailing the nutrient artery often becomes severed but this does not lead to any serious complications since the nutrient artery supplies the bone marrow and not the bone itself The reduction of the strength of the bone through thinning of its wall is without mechanical danger because the nail provides support until the bone wall regains its full thickness

The widening of the medullary canal should not be extended so far that it would break the bone This the only danger of the procedure can be prevented by cautious handling of the drill. Such an injury however would not be catastrophic for only longitudinal fractures mainly fissures would ensue

(1) Chirurg 30 28-35 January 1959

Even if infection were to set in its course would be the same as if no widening of the medullary canal had been performed Amputation was never necessary

Fractures of Femoral Shaft in Children with Special Reference to Subsequent Overgrowth were studied by Bent Barfod and Johannes Christensen[2] (Aarhus Denmark) Fractures of the femoral shaft in children differ in many ways from those seen in adults union occurs rapidly pseudoarthrosis is almost unknown and there is a pronounced tendency to spontaneous correction of deformities However the greatest difference is that in children the growing bone tends to respond to fractures and other influences with growth acceleration

Opinions diverge as to the best treatment for fractures of the femoral shaft in children and especially as to whether accurate reduction should be attempted. Use of osteosynthesis in children has had relatively few advocates Many claim that open reduction with osteosynthesis is not indicated in children since satisfactory results can always be obtained by various conservative methods

Follow up studies were conducted on 114 children under age 15 who were treated 2 12 years previously for fractures of the femoral shaft Osteosynthesis was used in 23 and conservative treatment in 91 Duration of treatment was longer for osteosynthesis than for conservative therapy

Overgrowth of the injured limb after conservative treatment seems to bear a direct relation to the shortening observed at discharge which suggests that a desirable compensation occurs Of the fractures treated conservatively about 80% showed normal length ± 1 cm at follow up examination After osteosynthesis overgrowth in comparison with the uninjured limb always occurs follow up examination revealed lengthening in excess of 1 cm in 20 of the 23 patients so treated

Shortening of at most 2 cm angulation of less than 25 degrees and absence of rotation should be the aim of therapy These may always be attained by conservative treatment and osteosynthesis of fracture of the femoral shaft in children is not indicated

► [In this clinical study of 114 children the overgrowth of the femur after fracture substantiates the experimental studies of Greville and Janes

(2) Acta chi scandina 116:235-250 1958/1959

(1958-59 YEAR BOOK p. 125) who concluded that the increase in growth came entirely from the epiphysis and varied according to the type of fracture and displacement. No difference in growth was found between bones in which the nutrient artery was ligated and those in which it was left undisturbed. The increase occurred at the lower end in the lower femoral epiphysis and varied directly with displacement. Certainly the two studies together would seem to indicate that conservative treatment for fractured femurs in children is to be preferred to open reduction and internal fixation.—Ed]

Fatigue Fracture of Pelvis and Lower Extremity. C. C. Wang, C. W. Lowrey and R. L. Severance[3] record 97 fatigue fractures observed in 83 patients at the US Army Hospital, Fort Chaffee. The fractures commonly occurred in recruits 4-5 weeks after start of basic training and were strikingly frequent in midwinter when heavy clothing and boots were worn. The first symptom was usually constant dull

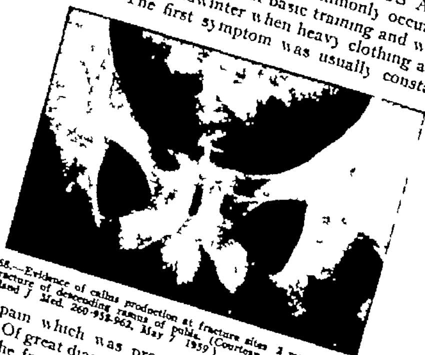


FIG. 68.—Evidence of callus production at fracture sites 3 months after bilateral fatigue fracture of descending ramus of pubis. (Courtesy of Wang, C. C., et al.: New England J. Med. 260:958-962, May 7, 1959.)

aching pain which was promptly relieved by non weight bearing. Of great diagnostic interest was the reproduction of pain at the fracture site by forceful percussion of the ends of the bone. Point tenderness was also elicited at the fracture site.

In 2 patients with 4 fatigue fractures of the pelvis the fracture lines were detected roentgenographically at the junction of the pubic and ischial bones (Fig. 68). Callus formation was noted in the late stage of the disease. In 3 patients with 4 fatigue fractures of the femur (Figs. 69 and 70)

(3) New England J. Med. 260:958-962, May 7, 1959.

the fracture lines occurred in the lower third of the shaft, about 15 cm proximal to the knee. Of 8 tibial fatigue fractures observed in 8 patients all occurred in the upper third, about 12 cm distal to the knee Periosteal reactions were



Fig 69 (left) —Fatigue fracture of distal femur with tiny cortical break and minimal periosteal reaction

Fig 70 (right) —Evidence of massive callus formation 6 weeks later

(Courtesy of Wang C. C., *et al* New England J Med. 260:958-962, May 7 1959)

usually large in fractures of the femur and tibia An irregular sclerotic zone often diagnostic of this condition was observed lying transversely across the shaft to denote the fracture site

In 4 patients with 6 fractures of the os calcis (Fig 71) there was only a small amount of periosteal reaction but a prominent irregular curvilinear sclerotic line occurred in the

posterior portion of the bone Of 75 fatigue fractures of the metatarsal bones in 66 patients 95% occurred in the 2d and 3d metatarsals at the middle and distal thirds of the shafts The fracture line was often hardly noticeable and the condition was diagnosed only by the presence of periosteal reactions at the fracture sites After 2-4 weeks exuberant periosteal callus was typical of this condition Absolute bed rest for 10 days usually sufficed for relief of

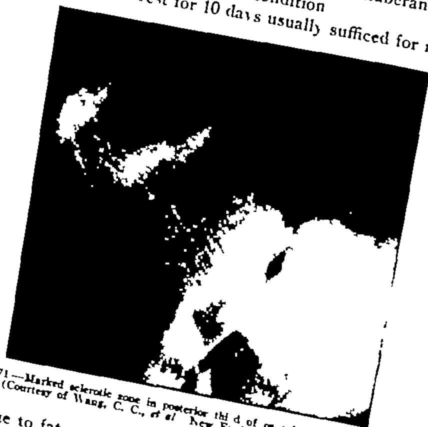


Fig 71.—Marked sclerotic zone in posterior third of os calcis, indicating fatigue fracture (Courtesy of Wang, C. C., *et al* New England J Med. 260 958-962 May 7 1959)

pain due to fatigue fracture Gradual ambulation was then started and regulated by the presence of pain Limited ambulatory work was usually possible in 1 month and patients were able to return to training in about 6-8 weeks

► [Fatigue fractures in any bone can offer a challenge in diagnosis. Recently I had an opportunity to see a patient who complained of pain in the perineum On initial x-ray nothing abnormal was found. The patient obtained some relief by injection of the adductor tendon origins with hydrocortisone However the pain persisted and 3 months later a tumor mass was found involving the inferior pubic ramus. Biopsy disclosed that the mass represented a healing or fatigue fracture of the pelvis The patient has gone on to full recovery The finding of these bone changes may often be confusing and sometimes only a biopsy will establish a definite diagnosis —Ed]

Treatment of Recurrent Dislocation of Patella by Method of MacCarroll and Schwartzmann is described by Preben Thestrup Andersen[4] (Copenhagen) Indications for operation in recurrent dislocation are (1) tendency to dislocation, (2) instability (3) muscular atrophy (4) progressive changes in the statics of the knee and (5) arthrosis of the knee joint

The principle of this procedure is simultaneous transplantation of the inferior patellar ligament and the tibial tuberosity medially and inferiorly combined with plastic repair of the tendon of the semitendinosus This muscle is divided at the tibial condyle and shifted subcutaneously to the anterior surface of the patella To eliminate the tension on the lateral aspect of the knee division of the extensor mechanism up to the base of the patella should be performed since the patella cannot otherwise be pulled downward sufficiently The high position of the patella should be overcome in the operation to give sufficient tension to the quadriceps—an important factor in the re-education of this muscle.

After operation a plaster cast is worn for 8 weeks followed by re-education of the muscles The patient is permitted to use the leg (in cast) from the 14th postoperative day

The MacCarroll Schwartzmann operation was used in the treatment of 36 patients with recurrent dislocation of the patella associated with a variable degree of dysplasia of the knee joint There were 27 women (average age 26 4 years) and 9 men (average age 23 6) The observation periods varied from 18 months to 7 years and averaged 4 6 years In 26 patients there were no signs of instability dislocation or arthrosis at follow up examination Six patients showed evidence of incipient arthrosis but no signs of instability recurrent dislocation or swelling of the knee joint 2 still showed instability and 2 had recurrent dislocation

The incidence of recurrence was lower in this series than has been observed following other methods of surgical treatment of dislocation of the patella In 2 patients pronounced valgus deformity of the knee was eliminated by the MacCarroll Schwartzmann operation The incidence of incipient arthrosis was no higher than is expected after any type of surgical intervention for this condition

(4) Acta chir scandinav 117 252 257 1959

Treatment of Fractures of Patella by surgical repair increased steadily in popularity during 1920–40 and soon became the preferred procedure A multiplicity of reports appeared on various methods of repair, each stressing the importance of carefully preserving each fragment and suturing it meticulously into place, as one would fit a jigsaw puzzle The main preoccupation of this period was with the method, not with principle Catgut, fascia lata kangaroo tendon, silk wire or braided wire—all had their proponents



Fig 72.—X ray made 3 months after fracture of patella that was treated by wire suture. Patient fell and refractured patella 2 months after suture; wire suture was done again. Patient was discharged as healed a week before this x-ray was made. There was no intervening accident or incident. Three months after patellectomy he was back at work with 45-degree flexion, and 3 years after patellectomy he had normal motion and no pain. (Courtesy of O Donoghue D H.: Northwest Med. 57: 1591 1600, December 1958.)

Many surgeons encountered the obvious impossibility of suturing all fragments and had more or less surreptitiously discarded pieces that would not fit. If the patella was completely fragmented there seemed no recourse but to remove it all If one or more large pieces were available they were preserved and the tendon was carefully sutured to the remaining fragments

Don H O Donoghue[5] (Univ of Oklahoma) considers patellectomy the treatment of choice for all fractures of the patella with the following definitely circumscribed exceptions.

(5) Northwest Med. 57 1592 1600 December 1958

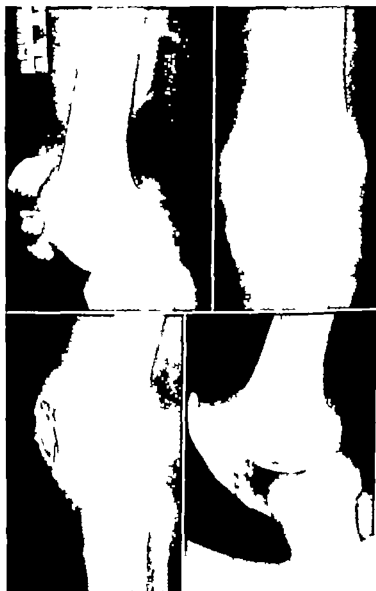


Fig 73 —Comminuted fracture of lower half of patella treated by reposition of fragments (1939) Other multiple injuries prevented operation for 2 weeks, until abrasion healed. The considerable calcification is a great handicap to this heavy patient *Primary procedure should have been suture of upper fragment if feasible, or patellectomy* (Courtesy of O Donoghue, D H. Northwest Med. 57 1592 1600, December 1958)

(1) Fractures without displacement and without obvious chondral damage should be treated by aspiration injection of hyaluronidase compression splinting until swelling subsides and then a long leg cast for 4 weeks or more (2) Fractures of the patella with polar fragments either at the upper or lower end should be treated by meticulous removal of all

fragments and repair of the tendon to the remaining single fragment Function should then be tested on the operating table to see that the patella does not rock forward in flexion Unless the sliding motion is smooth and without tilt, the fragment should be removed and patellectomy completed One should not leave an obviously abnormal fragment with severe chondral damage (3) Lateral marginal fragments may be removed with the same restrictions as in (2)

Aside from these exceptions patellectomy should always be done, within a few hours if possible A longer delay may result in several days or even weeks of disability due to abrasion infection circulatory blebs and contaminated cuts There is no margin for compromise with infection This principle applies even more specifically if bone is to remain

There is no justification for any attempt to obtain repair of bone to bone

► [Figure 72 illustrates the fallacy of attempting to suture by wire two fragments of the patella together and hope that they will unite satisfactorily These two fragments separated 2 months after suture and the patient responded well to a patellectomy Figure 73 illustrates what frequently happens after attempt to suture a comminuted patellar fracture. The patella ultimately became markedly distorted and obviously formed an irritating source to the knee joint and the patient would have been treated much more satisfactorily by primary patellectomy

To those who are doubtful regarding removal of the patella and possible weakening of the extensor mechanism of the knee joint I would like to point out that the common ground mole has a patella that is markedly oversized for its legs and yet this animal probably has the weakest hind legs in relation to body size of any animal in existence. On the other hand, the kangaroo, with probably the strongest hind legs for its body size, has no patella at all. Certainly in fractures of the patella, if there is any doubt as to treatment, a patellectomy is to be strongly recommended. Not only will function ultimately be better after healing of the surgical wound, but the possibility of future traumatic irritation of the knee joint will be avoided.—Ed.]

Patellectomy Repair of Extensor Mechanism. Fifty years ago Murphy described a procedure in which a flap of quadriceps tendon and muscle is used to reinforce the defect left by removal of the patella (Fig 74) Other variations of this principle have been described Howard B Shorbe and Chauncey H Dobson[6] (Oklahoma City) describe a procedure termed inverted V plasty In this technic an inverted V flap is fashioned from the quadriceps tendon and inserted into the patellar ligament (Fig 75) The procedure is simple provides strong closure requires short convalescence and yields good functional results Cosmetic results are

(6) J Bone & Joint Surg 40-A:1281 1284 December 1958.

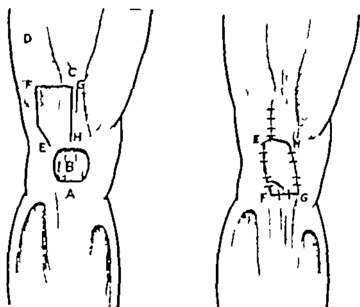


Fig 74—Murphy's technic *A* patellar ligament; *B* defect left by excision of patella; *C* quadriceps tendon, *D* vastus lateralis *E H* flap fashioned from quadriceps mechanism. (Courtesy of Shorbe H B, and Dobson C. H.: J Bone & Joint Surg 40 A 1281 1284 December 1958.)

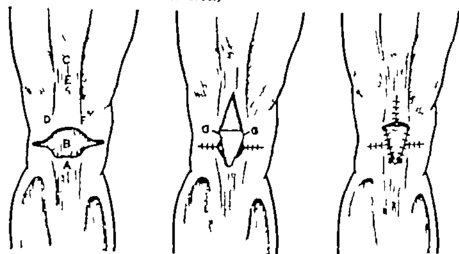


Fig 75—Authors technic. *A* patellar ligament *B* defect left by excision of patella *C* quadriceps tendon *D F* flap fashioned from quadriceps tendon; *G* angle sutures. (Courtesy of Shorbe, H B and Dobson, C. H. J Bone & Joint Surg 40-A 1281 1284 December 1958)

good, because the reflected flap gives a fullness to the anterior surface of the knee that superficially resembles a patella.

Among 40 patellectomies done by 6 orthopedic surgeons using various methods V plasty was found to yield consistently good results in all types of cases In most cases simple excision of the patella also yielded excellent results The pos

sibility may be considered of reserving inverted V-plasty for patients in whom damage has occurred to the extensor mechanism that cannot be easily repaired by simpler methods However inverted V plasty is not difficult and may be used in virtually all patients requiring patellectomy

► [This method of patellar tendon repair following patellectomy is intriguing. Many surgeons have endeavored to use the thin covering of the anterior surface of the patella to repair the patellar tendon defect but frequently it has been my observation, this material dies because of lack of blood supply. The new technic described by the authors may obviate this factor and by turning down a flap of the patellar tendon a reinforcement of the patellar tendon anastomosis may be secured.—Ed.]

Fracture of Intercondylar Eminence of Tibia though not common occurs more often among children than among adults Marvin H Meyers and Francis M McKeever[7] (Los Angeles) present criteria for treatment drawn from a study of 45 patients Ten were adults and 35 were children who had not yet reached skeletal maturity Average follow up was 3 years

In adults fracture of the intercondylar eminence of the tibia is so often accompanied by serious injury to the supporting structures of the knee or other bone injury that serious permanent disability often results In children the fracture occurs as an isolated injury without damage to the other supporting ligaments or gliding surfaces of the knee joint. Prognosis for complete recovery in this age group is excellent

Fractures of the intercondylar eminence in children may be divided into three types as demonstrated by x rays In type I there is no dislodgment of the fragment from its bed of origin In type II there is partial dislodgment of the fragment but still good apposition of a large portion of the fragment. In type III there is complete dislodgment of the avulsed fragment with no bone apposition

Treatment of types I and II fractures should be simple and should consist of aspiration of the hemarthrosis when the joint is tense followed by immobilization of the knee in a well fitting toe to-groin cast The cast should be applied with the knee in a comfortable flexed position no attempt being made to extend the knee beyond this comfortable position Open reduction is not indicated in types I and II fractures

Type III fracture requires open reduction with replace-

(7) J Bone & Joint Surg 41 A 209-222, March, 1959

ment of the avulsed fragment in its bed Metallic fixation is not necessary to retain the fragment If retention is necessary, a simple absorbable suture passed through the thin edge of the fragment and through the meniscus near its sharp margin will give adequate fixation After open reduction the entire leg is immobilized in a toe to groin cast with the knee

END RESULTS IN 45 PATIENTS CLASSIFIED BY TYPE OF FRACTURE AND TREATMENT IN 35 CHILDREN

	Excellent	Good	Poor	Unknown
Adults (10)	2	1	7	0
Children (35)	30	2	1	2
Type I fracture	9	0	0	1
Type II fracture	16	1	0	0
Type III fracture	5	1	1	1
Treatment				
Immobilization	22	0	1‡	1
Arthrotomy and reduction	6	1	0	1
Excision of fragment	2	1	0	0

Due to nonunion and formation of loose body
‡Good result after removal of ununited fragment (type III fracture) 11 years after injury

joint in a comfortable flexed position Late open reduction is possible One child was not treated until 5 months after injury

End results of treatment in the 45 patients are shown in the table

Fifty Osteosyntheses by Screws or Fixed Grafts for Recent Fractures of Tibia are described by H Evrard and P Parvais[8] In 19 oblique fractures in which immobilization was effected by screws reduction was always excellent with solid stabilization In 17 patients on whom follow up was possible union occurred in 3 months Invalidism usually lasted 4 months this was lengthened by the period before operation and depended on whether or not orthopedic reduction had been attempted Functional results were very good. Among 2 cases classified as good," in 1 there was a spiral fracture of the tibia in which recovery of tibiotarsal movements was rapid but malleolar edema with pain on walking persisted several weeks in the other operation was delayed until the 45th day and was followed by delirum tremens and amebic hepatitis there was slight tibiotarsal stiffness

A graft fixed with screws proved highly satisfactory in 31

(8) Rev chir orthop 44 416-428 Oct Dec 1938.

transverse fractures of the tibia It allowed anatomic reduction and solid stabilization which resulted in rapid consolidation strict respect of axes and lengths and reduced invalidism and incapacity Except in 3 cases all fractures treated surgically were united in periods practically identical with those treated successfully by other orthopedic methods Five of the patients operated on were lost to follow up The 3 cases in which union was delayed were explained as follows (1) a plurifragmented fracture with a large intermediate fragment in a patient who was not permitted to walk for 5 months (2) a transverse fracture of the upper third of the tibia in a man 59 who 2 years earlier had had an open fracture caused by a bomb burst which had left an eburnated bone the fixed inlay graft was fractured but the small graft in apposition to the anterior external surface permitted union in 5 months and (3) an open plurifragmented fracture in which there was a significant deviation between the upper and lower screws the intermediate fragments had not been perfectly reduced and were immobilized in grafting by a circular nylon thread the graft fractured after 5 months under a walking cast In this last case union was not obtained until the end of 10 months and the patient (an alcoholic) was left with a hypertrophic callus and a slight curvature but with good joint mobility

Fractures of Shaft of Tibia Clinical and Experimental Study R W Jackson and Ian Macnab* (Toronto Gen l Hosp) in reviewing 368 cases of simple and compound fractures of the shaft of the tibia found that only 16% showed union within 3 months and only 62% by 6 months Even after 18 months there were still 2% ununited and 2% had required amputation

Various factors possibly influencing rate of union were investigated Blood supply was studied by injection of the vascular network in cadavers and dogs This revealed that the nutrient vessels run longitudinally and when the bone is broken experimentally with complete interruption of the endosteal circulation the distal fragment becomes avascular The periosteal blood supply however is intact on both sides of the fracture line since the periosteal vessels run transversely to the long axis of the bone (Fig 76)

(9) Am J Surg 9 543 557 May 1959

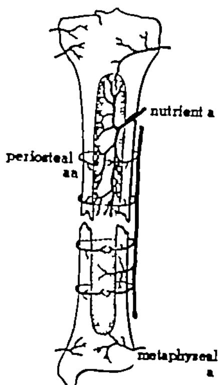


Fig. 76.—Periosteal blood supply in fracture of tibia. (Courtesy of Jackson, R. W and Macnab, I Am. J Surg 543-557 May 1959)

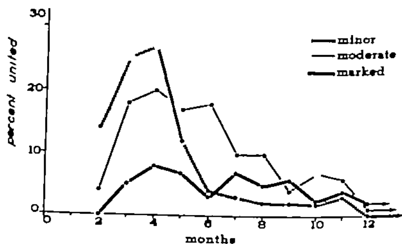


Fig 77 Rate f union in 214 tibial fractures with varying degrees of displa ment, showing percentage successfully united each month. (Courtesy f Jacks R. W., and Macnab, I. Am. J Surg 97 543-557 M y 1959)

The importance of the periosteal seal can be demonstrated by a simple experiment If a portion of the fibula is resected the gap produced is filled by surrounding tissues and no attempt is made to bridge the gap with bone. However if the defect in the fibula is bridged by a polyethylene tube filled with blood new bone grows down the tubing and reconsti-

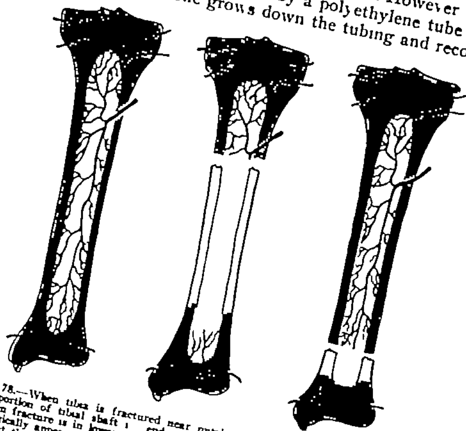


Fig 78.—When tibia is fractured near nutrient artery i.e., in middle third, greater portion of tibial shaft is rendered relatively avascular at time of accident than when fracture is in lower third. Revascularization of distal fragment, therefore, would logically appear easier in fractures of lower than of middle third. It was believed that there was experimental evidence to show that the relatively avascular cortex acted as a stimulus to greater callus production. Clinically callus production always more profuse in fractures of upper than of lower third. Experimentally however a great amount of callus can be produced in lower third if endosteum is reamed out and medullary canal filled with wax producing death of cortex. (Courtesy of Jackson, R. W and Macnab I. Am. J Surg 97 543-557 May 1959)

tutes the fibula If the experiment is repeated using a perforated polyethylene tube fibroblasts spread in through the perforations and the defect is bridged by fibrous tissue only Experiments on the blood supply of the tibia suggested that the damage sustained by the periosteum at injury played a vital role in the rate of union of fractures To determine whether the degree of initial displacement of the bony fragments might give some indication of the periosteal damage

sustained 214 tibial fractures which united without secondary procedures were analyzed. The only means of assessing the degree of initial deformity was the displacement revealed in the first x-ray films taken after fracture. The degree of initial displacement was arbitrarily classified as minimal, moderate and marked. The time taken for the fracture to unite was correlated with these various classifications of initial displacement (Fig. 77). Of the fractures with marked initial displacement, 89% were still ununited 6 months after injury.

Fractures of the middle third just distal to the entrance of the nutrient artery render a greater portion of the shaft avascular than fractures of the lower third, where the fracture line lies nearer the distal metaphysial vessels and revascularization of the distal fragment is easier (Fig. 78).

Comparison of treatments revealed union to be quicker with closed than with open reduction. Results also showed that the greater the extent of soft tissue damage and compounding, the slower was the healing process.

In fractures requiring bone grafting because of delayed union or nonunion, the authors believe that this should not be done unless 6 months has elapsed since initial treatment. At that time, if there is any definitive indication that union might take place, a further delay is justified; in the absence of such indications, grafting should be done.

► [In support of the theory presented in this paper I would like to say that recently an inlay graft was placed in a fracture at the junction of the middle and lower thirds of the tibia together with Phemister iliac grafts. It was most interesting that whereas the Phemister grafts united and formed a good union across the fracture site, the inlay graft united only in the superior fragment while that in the proximal fragment remained devitalized and eventually sequestrated. It was necessary to remove the devitalized portion of the graft before the sinus due to the devitalized foreign body could be made to heal.—Ed.]

Intramedullary Nailing for Tibial Fractures. Robert P. Shanewise[1] (Spokane, Wash.) suggests a method for nailing of closed fresh tibial fractures.

TECHNIC.—A nail of suitable length is introduced through a ⅜ in. drill hole in the proximal tibial metaphysis. The drill hole is placed ½ in. medial to the tibial tubercle and directed down the tibial shaft. The nail is introduced through the drill hole and driven down the shaft to the fracture site. The surgeon manually reduces the fracture and the nail is driven by an assistant across the fracture site into the distal fragment.

(1) Northwest Med. 58:985-986, July 1959.

Because the entire anteromedial aspect of the tibia is subcutaneous most fractures can be reduced without opening the fracture site. The operative procedure is relatively simple and usually takes 30-45 minutes. For ununited or old fractures it is always necessary to open the fracture site and to ream the medullary canal to accommodate the nail

Originally, it was believed that only transverse and short oblique fractures in the middle third of the tibia were suitable for nailing Indications, however, have greatly broadened to include open and closed fractures, as well as segmental and certain comminuted shaft fractures More recently, this technic has been applied to ununited tibial fractures both closed and infected.

Intramedullary nailing of tibial fractures should be used when the method will provide adequate immobilization of the fracture or maintenance of alignment of the fracture fragments in patients with severe comminuted or segmented fractures

Advantages of intramedullary fixation include high incidence of bony union and early ambulation in most patients in a long leg walking cast without crutches It has been amply demonstrated that the intermittent physiologic compression of weight bearing stimulates fracture union The general rule has been established that if one third or more of the major fracture fragments are in contact the patient can go to immediate weight bearing Patients may be ambulatory without casts, in most instances in 2 or 3 months even though complete bony union is not present on x ray

The disadvantages and complications of this method are almost entirely attributable to poor selection of patients by persons unfamiliar with the inherent limitations of the method and to technical difficulties occurring at surgery

Internal Fixation of Fibula in Fractures of Both Bones of Leg is effective treatment in selected patients E Burke Evans and George W N Eggers (Univ of Texas) found the method effective in supramalleolar fractures badly comminuted or compound diaphysial fractures transcondylar fractures and fractures with non or malunion The effectiveness of the method is explained by the anatomic relationship of the fibula and tibia. The fibula is the natural splint of the tibia being firmly bound to the larger bone through the ligaments of one diarthrodial joint the proximal tibiofibular

(3) J.A.M.A. 169:321 326 Jan. 24 1959

and of one syndesmosis the distal tibiofibular and through the fibers of the interosseous membrane this relationship constituting a second syndesmosis

Of 15 patients with fracture of both bones of the leg treated by internal fixation of the fibula 11 had acute fractures of the supramalleolar region Fractures at this level



Fig 79 (left) —X ray dated Sept. 22 1952 showing transverse compound supramalleolar fracture, with no joint involvement, in man 56.
Fig 80 (right) —Appearance of fracture on Apr 14, 1958.
(Courtesy of Evans E. B., and Eggers, G W N: J.A.M.A. 169:321-326, Jan. 24 1959)

tend to be severely comminuted and disorganized because of lack of soft tissue support and are often compounded.

Perhaps the more common methods of handling supramalleolar fractures are by manipulation and plaster only or by incorporation in plaster of distracting Steinmann pins through the calcaneus and proximal tibia Reassemblage of the tibial fragments may be attempted by use of multiple transfixion pins or screws but it is hazardous to disturb these fragments from the original clot because their blood supply is at best precarious Because of the level of fracture, metal fixation of the tibia is usually impractical or ineffective.

The fibular involvement in these fractures often is less than that of the tibia there being a simple or moderately

comminuted closed fracture If the fibula is reduced and stabilized the fracture is then in a sense one of the tibia alone tibial length is restored fragments may be to some extent controlled or manipulated and alignment is often surprisingly good That most of these fractures are open makes even more desirable the fixation of the fibula which may be approached through untraumatized tissue.

If the fragments will accommodate a plate this type of



Fig. 81 (left).—X-rays taken Jan. 7 1955 showing compound comminuted spiral-oblique supramalleolar fracture, with no joint involvement, in man, 43.
Fig. 82 (right).—X-rays dated Mar. 25 1958, show use of slotted plate to maintain reduction in fibula.
(Courtesy of Evans, E. B. and Eggers, G. W. N.: J.A.M.A. 169:321-326, Jan. 4 1959.)

fixation is used If the distal fragment is short intramedullary fixation is used. Use of a plate is favored when possible because the procedure necessitates but one incision and because the extreme narrowness of the medullary cavity in some fibulae makes difficult the introduction of a pin or nail of adequate caliber Shortening of the fibula may be necessary in fractures when there is loss of tibial substance or tendency to medial settling

The stability gained with fibular fixation facilitates plaster application After open reduction a long leg posterior plaster splint or bivalved circular plaster is used Straight long leg circular plaster is applied after suture removal and subsidence of swelling Some effort should be made to control with plaster the tendency of the fracture to settle.

Of the 11 supramalleolar fractures treated by the authors



Fig 83 (left)—X rays dated July 15 1957 showing compound supramalleol fracture of compression type with pronounced joint involvement, in woman, 37
Fig. 84 (right)—X rays dated Mar 4 1958 showing reduction and control short fibular fragment with Rush nail. Consolidation occurred at 4 months.
(Courtesy of Evans, E. D., and Eggers, G W N : J.A.M.A. 169:321 326, Ja 24 1959)

3 were transverse (Figs 79 and 80) 3 were spiral obliqu (Figs 81 and 82) and 5 were compressed (Figs 83 and 84 Treatment in 3 was with intramedullary nails and in with slotted plates The time of fracture consolidation varie from 3 to 6 months There was 1 nonunion In this patien fibular fixation was also used in the secondary graftin procedure

► [We all recognize that an intact fibula is an excellent splint for a fracture of the tibia and often prevents displacement. Certainly the oper tion as advocated by the authors is an excellent method in selected cas for treatment of problem fractures of the tibia.—Ed.]

Technic of Closed Bone Marrow Nailing with Tubula Slot Nail (Rohrschlitznagel) in Recent Fractures of Tib was developed by Kt. Herzog[3] (City Hosp Krefel Germany)

Technic.—A skin incision, 23 cm. long is made along the anteri edge of the shin bone starting at the tibial tuberosity This incisio cuts through the patellar ligament. At the lower end of the incision punch is pushed into the bone marrow cavity (Fig 85 *A*) After th punch reaches the cavity it is moved so that its axis runs parallel the long axis of the tibia (*B*) Through the bone a curved probe is in troduced into the medullary cavity (*C*) Along the probe a so-calle exploring nail (*D*) is driven into the tibia. The diameter of this na should be 1 mm. less than that of the final definite nail. The purpo of the exploring nail is to prepare in the compacta and spongiosa free bed for the final nail After removal of the curved probe and ex ploring nail the final probe is introduced (*E*) The final probe

(3) Chirurg 29 501 506 November 1958

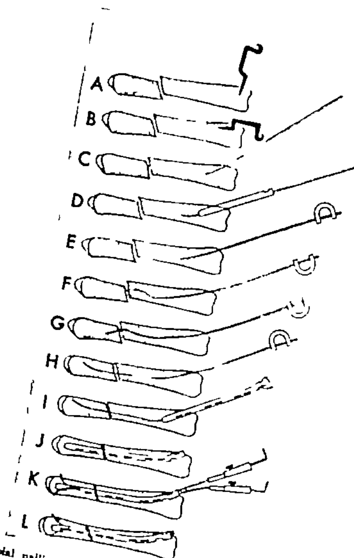


Fig 85.—Tibial nailing. *A* driving of punch perpendicularly into tibia at its anterio margin where hard bone goes over into soft area. *B* punch is in horizontal direction and is forwarded along long axis of tibia. *C* introduction of p obe which markedly curved near its tip *D* boring exploring nail over exploring probe along at etch of 4-6 cm. *E* after removal of exploring p obe and exploring nail introduction of slightly curved, final probe, 75 cm. long which carries Kirschner stirrup at proximal end. *F* turning of probe by 180 degrees, which otherwise would penetrate between bone fragments into soft tissues. *G* rotated probe reaches fracture line and, by further advancement, reaches distal bone fragment. *H* further advancement and r sewed turning of probe by 180 degrees, thus decreasing lateral displacement. *I*, driving in of final bone-marrow nail along probe. Nail reached critical depth at 7 cm where it starts to bend. *J* nail reached its final depth and lateral displacement is corrected. *K* two latch wires driven into periphery and their ends are still connected with latch wire holders. *L* latch wires are cut off above upper end of nail nd cm. long incision wound is closed. (Courtesy of Herzog Kt.: Chirg 29 501 506 November 1958.)

slightly curved at its tip and has a stirrup at its proximal end. The latter corresponds with the direction of the curving at the tip of the probe

Before the final nailing x rays are taken in two positions to visualize exactly the position of the bone fragments to the final probe The probe is then turned 180 degrees around its axis so that its tip can easily reach into the distal bone fragment (*F* and *G*) It is turned again by 180 degrees so that the tip points toward the anterior edge of the tibia The probe is then pushed forward up to within a few centimeters of the talus (*H*) The final nail is now driven in along the probe. At the depth of about 7 cm a critical situation develops (*I*) inasmuch as the nail reaches the posterior wall of the compacta. The probe has to guide the nail from here on along the long axis of the tibia After the nail reaches its end point a dehiscence may have to be closed (*J*)

After placement of the nail wires which run through the nail slots are pushed through the compacta (*K* and *L*) and are cut short outside the tibia.

Football Injuries in "Big 10 University are evaluated by Richard Patton[4] Football is a rough sport. Injuries are bound to occur in a game in which two 200-lb men come in contact at a speed approaching 40 mph From 1947 through 1957 slightly over 2 000 injuries were observed among members of the football squad at Ohio State University No player had measurable permanent disability from an injury The time the members of the squad lost from school because of injuries was nearly equal to the time lost because of other illnesses Some of these men do have disability in that they are unfit to play football In the 10 years 20 men were considered unfit to participate in football because of injuries

Knee injuries are by far the commonest football injuries (Fig 86) One out of 4 of the injuries severe enough to cause the player to miss practice was an injury to the knee. Such injuries accounted for half of the total amount of disability and half of the major surgical procedures One out of 7 disabling football injuries involved the ankle 1 out of 7 the shoulder and 1 out of 10 the head

Many of the minor injuries and also many injuries causing disability were due to local trauma and could be classed as hematoma bruise or muscle strain The three conditions are similar in that the major problem is local collection of blood in the tissues

Conservative management of these injuries consists of immediate application of cold and pressure for at least the first

(4) Postgrad. Med. 25 702 707 June 1959

24 hours, followed by heat massage and activity until tenderness has lessened and the blood is absorbed Aspiration or surgical drainage of a large hematoma is only occasionally indicated

For the past 6 years in addition to this conservative treatment local injections of hyaluronidase were given The hyaluronidase usually was dissolved in 10-20 cc. of 0.5% procaine for injection and was given early, as soon as possible

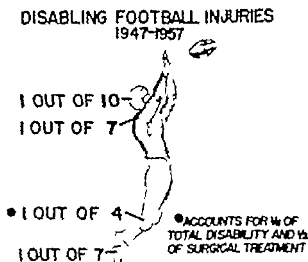


Fig 86. (Courtesy of Patton, R. Postgrad. Med. 25:702-707 June 1959.)

after injury The local injection of hyaluronidase has definitely helped in hastening absorption of blood and fluid in injured tissues The drug has been of tremendous help in preventing the prolonged local spasm that often occurred in the past in association with a pulled muscle The pull of the quadriceps or hamstring muscles is a minor problem after hyaluronidase is injected Before use of the drug it was not unusual for players to have sore stiff muscles with frequent reinjuries and difficulty in running for 2 5 weeks

Prevention of Injuries in College Athletics. The true incidence of sports injuries is not known because of lack of accurate statistical data Study by Augustus Thorndike[5] (Harvard Univ) shows that in the past 22 years there has been a great increase in sports participation at Harvard (Table 1) At present about 76% of the students take part in organized sport The records of 14,375 contestants in organized col

(5) J.A.M.A. 169 1401 1409 Mar 28, 1959

lege athletics over a period of 17 years showed 3453 injuries severe enough to exclude the player from one or more subsequent practice or game sessions This high incidence (24%) indicates the need for insisting on the player's bill of rights This includes good coaching good equipment and good medical care The medical care includes a thorough preseason examination the presence of a physician on the playing field at every scrimmage and game and due respect for his authority

Preseason conditioning exercise to develop muscle tone is absolutely necessary Not only sprains but muscle and ten

TABLE 1—TOTAL NUMBER OF ATHLETES IN ORGANIZED SPORTS IN HARVARD COLLEGE FROM FALL, 1932, TO SPRING, 1954

SEASON	1932 37	1937-42	1942-47	1947 54	TOTALS
Fall	3,271	2,477	703	6 485	12,936
Winter†	1,235	1 662	280	8,895	12,072
Spring	2,112	2,720	445	7,670	12,947
Total	6,618	6,859	1 428	23,050	37,955

Last period is for 7 academic years rather than 5 Since 1947-48 varsity and junior varsity football participant have been averaged.

†Figures for winter sport include only hockey and winter track, the only major sports in that season until 1937 when swimming and basketball were made major sports.

don strains can be prevented in many cases by proper conditioning before the first practice session

Equipment manufacturers take their responsibilities very seriously and are continually modifying and improving the various types of armor worn in contact sport The problem lies in the false economy of using worn-out, outmoded or ill fitting gear Another item contributing to the incidence of injury is the player's apathetic attitude toward the proper adjustment of pads

The team physician must be familiar with the more common types of injuries produced in athletics (Table 2) and likewise the more commonly injured parts of the body He must determine whether a limping player should be taken out of competition he should arrange with the team captain to call time out for any needed examination Also he should be familiar with the functional testing of joints the more common sites of fractures and the simpler tests for diagnosis of type of injury In instances of head injury he should be alert and ask the player simple questions to determine whether there is amnesia with loss of orientation of time and place

TABLE 2.—Types of Injuries Incurred Most Commonly in Sports at Harvard University*

Injury	1932-37	1937-42	1942-47†	1947-52	1952-54	Totals
Sprains	636	426	210	344	86	1,702
Strains	363	287	96	145	53	944
Contusions						
Joint	219	73	87	52	17	448
Muscle	526	350	111	60	18	1 065
Simple	281	93	103	97	22	596
Fractures and dislocations	223	232	105	181	47	788
Lacerations and abrasions	264	89	25	40	6	424
Inflammations and infections	300	131	66	48	9	554
Internal injuries	102	81	39	115	26	363
Miscellaneous	243	152	67	42	6	510
Totals	3 157	1,914	909	1 124	290	7,394

*Data from Thorndike, A.: *Athletic Injuries* (4th ed.; Philadelphia Lea & Febiger 1956) p. 66.
†From fall, 1943, until spring, 1946 sports were on wartime basis, with organized sports continued only informally and on limited basis.

There is no reason to think that an acutely sprained ligament can be supported by adhesive strapping so that the player can return immediately to play without irreparable harm to the injured ligament. The torn ligament should be permitted to heal before stress is put on it. The team physician must be responsible for determining when an injury is healed and the player is ready to return to play To avoid recurrent ligament sprains, proper protective adhesive strapping is important before every practice and game.

Management of Ankle Injuries Sustained in Sports. Thomas B Quigley[6] (Harvard Med. School) notes that much protection against ankle injuries is afforded by regular use of ankle wraps. Applied over the inner of two pairs of socks with a turn around the heel (Fig 87) these nonelastic bindings which the player applies himself effectively limit lateral mobility without interfering with flexion or extension When they are required of all players at all practice sessions and games the incidence of ankle injuries can be reduced at least 50%

Displaced bi or trimalleolar fractures in young athletes almost always require operation Precise closed reduction is difficult, since no fixed point remains on which to hinge manipulation and interposed soft tissue between the fragments of the medial malleolus is the rule rather than the ex

(6) J.A.M.A. 169 1431 1436, Mar 28, 1959

ception Little less than anatomic perfection can be accepted in these severe multiple ligament and bone injuries since the young men affected have at least 5 decades of use of their ankles ahead of them Only the most trivial fractures not involving ligaments can be safely treated by a short leg boot and weight bearing device Torsion within a walking boot



Fig 87—Application of nonelastic protective ankle wrap. Edges of wrap ha been darkened to show basic turns of bandage. Turns around heel limit lateral mobility without interfering with flexion and extension. (Courtesy of Quigley T B J.A.M.A. 169 1431 1436, M 28, 1959)

can displace even the common and usually uncomplicated external rotation fracture of the distal fibula since concomitant injury to the deltoid ligament can be more severe than originally appreciated.

If at first examination within moments of injury the damage is found to be minor four principles of treatment are observed—cold compression rest and elevation. These are based on the concept that a sprain is a partial tear of a ligament with hemorrhage at the point of tear absorption of the resulting hematoma and replacement of the gap by fibroblastic scar The process is the same as the healing of any sterile wound No method has yet been found to accelerate the process beyond nature s rate but many are available which slow it down or disturb the end result These include

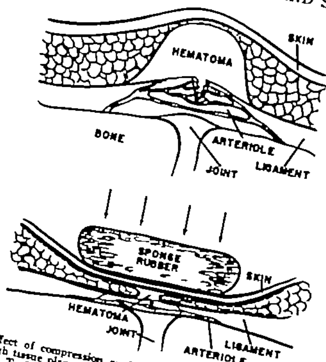


Fig. 88.—Effect of compression on hematoma accompanying sprain. Blood is disseminated through tissue planes, increasing its surface and speeding absorption. (Courtesy of Quigley T B. J.A.M.A. 169 1431 1436, May 28, 1959)

the use of procaine hydrochloride (Novocain) hydrocortisone rough manipulation and massage and running it out Cold promptly applied constricts the arteriolar bed and limits the hematoma Compression disseminates the hematoma already present and speeds its absorption by increasing its surface area (Fig 88)

Simple Aid to Reduction of Abduction External Rotation Fractures of Ankle is described by T B Quigley[7] (Boston) Fractures involving varying degrees of abduction and external rotation of the foot and tarsus in relation to the tibia and fibula comprise more than three fourths of all injuries to the ankle involving bone and ligament. These forces when sufficiently severe not only can fracture the fibula but also can tear the ligamentous attachments between the tibia and fibula rupture the deltoid ligament or avulse the medial malleolus wholly or in part

Reversal of this pattern of injury can be achieved by taking advantage of the simple fact that the lower extremity at rest with the body supine lies in external rotation If the

(7) Am. J Surg 9 488-493 April, 1959

limb in this position is suspended from directly above by the great toe, then the ankle and foot being of much less weight and mass than the leg and thigh fall into adduction internal rotation and supination

In clinical application it is neither necessary nor advisable to suspend the limb by the great toe If the limb is covered with stockinette fastened to the upper thigh with elastic tape

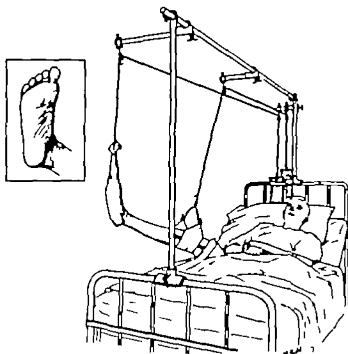


Fig 89—Stockinette suspension for external rotation-abduction fractures and avulsions of ligament. Foot and ankle naturally fall into position that is opposite of forces producing injury Reduction often effected without further manipulation. (Courtesy of Quigley T B: Am. J Surg. 97:488-493 April, 1959)

and suspended by the stockinette extending beyond the toes the same effect occurs Discomfort from hyperextension can be avoided by a sling beneath the knee (Fig 89)

The problems of interposed tissue between fragments of the medial malleolus and torn ends of ligament or anterior capsule trapped in the joint remain Portable x ray films after 1 or 2 days of suspension will often settle the matter showing slight separation of the tibial fracture faces an unnaturally wide gap between the talus and the medial malleolus or slight residual posterior displacement of the talus in the lateral view After edema has subsided appropriate operation can be undertaken Two cases are described

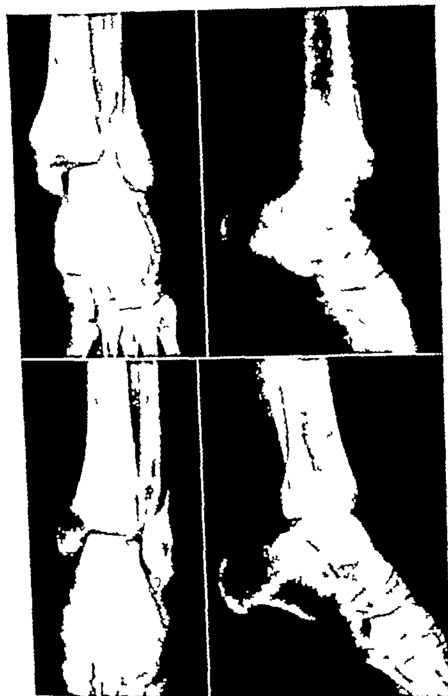


Fig. 90 (top).—Severe supination-external rotation fracture shortly after injury.
Fig. 91 (bottom).—Realignment produced by 12 hours of suspension in stockinette. Operation contraindicated by ulcer near medial malleolus. Ankle immobilized for 8 weeks in full-leg plaster cast. Solid union and normal function present 6 months after injury.
(Courtesy of Quigley, T. B.: Am. J. Surg. 97:488-493, April, 1959.)



Fig 92 (top) —Films taken shortly after severe supination external rotation injury Edema was pronounced.

Fig 93 (bottom) —Effect of 12 hours of suspension in stockinette Edema reduced to point that operation was possible.

(Courtesy of Quigley T B Am J Surg 97 488-493 April, 1959)

CASE 2.—Woman 48 twisted the left ankle X rays showed spiral fracture of the distal fibula characteristic of supination and external rotation forces and a medially displaced, almost horizontal flat spiral avulsion fracture of the distal three fourths of the medial malleolus (Fig 90) After suspension overnight, portable x ray films (Fig 91) showed reduction.

CASE 3.—Woman 54 twisted the ankle. X rays revealed gross lateral and posterior displacement of the tarsus and foot (Fig 92) After 12 hours of suspension posterior luxation was reduced (Fig 93) At surgery the medial malleolus was so fragmented that it could be held only by transfixing pins fashioned from Kirschner wires (Fig 94)

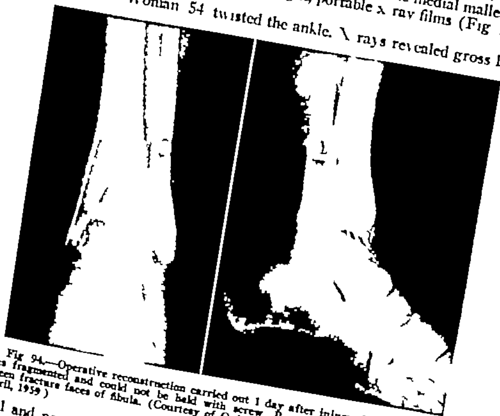


Fig 94.—Operative reconstruction carried out 1 day after injury Medial malleolus was fragmented and could not be held with screw P roneal tendons interposed between fracture faces of fibula. (Courtesy of Quigley T B Am. J Surg 97 488-493 April, 1959)

Treatment of Unstable Fractures of Ankle Paul W Braunstein and Preston A. Wade[8] observe that uncomplicated single malleolar fractures seldom lead to pain and disability but displaced unstable bimalleolar or trimalleolar fractures are often difficult to reduce and maintain in reduction On the combined Fracture Service of New York Hospital and the Hospital for Special Surgery there is an increasing tendency to treat these complicated injuries by open reduction and internal fixation

(8) Ann Surg 149 217 226, February 1959



Fig 95 (top) —Bimalleolar fracture exhibiting lateral and inferior displacement of malleolus and posterior and lateral displacement of lateral malleolus.
Fig. 96 (bottom) —Collison screw and Rush pin fixation leads to firm fixation and anatomic alignment.
(Courtesy of Braunstein, P W and Wade, P A. Ann. Surg 149 217 226, February 1959)

Bimalleolar fractures are treated by internal fixation of the medial malleolus by Collison screw fixation and on occasion by Rush nail fixation of the unstable lateral malleolus (Figs 95 and 96) Trimalleolar fractures are treated by screw fixation of the medial malleolus If there is posterior dislocation of the talus and a posterior malleolar fragment

involving one third or more of the tibial articular surface, posterior lip screw fixation is carried out through a postero-lateral approach Complete tears of the deltoid ligament are associated most often with lateral malleolar fractures In al most all these fractures, suture of the deltoid ligament is performed shortly after injury On several occasions, Rush nail fixation of the fibula has led to further stabilization in this injury Distal tibiofibular diastases are treated by tibio fibular bolt fixation if plaster immobilization with compres sion of the malleoli fails to maintain adequate reduction

Of 107 patients with displaced fractures of the ankle stud ied by the authors, 57 underwent primary closed reduction and 50 primary open reduction In the group with primary closed reduction 2 attempts at reduction were required in 28 cases 3 attempts in 7 and 4 in 1 Only 1 patient undergoing primary open reduction required a further attempt Over all results were considered excellent in 61% of patients who had open reductions but in only 34% of those with closed reductions

► [Open reduction of fractures of the ankle is becoming increasingly pop- ular because of the frequency of ununited medial malleolus fractures ob- served in former years Infolding of the periosteum results in nonunion in many cases, and certainly in fractures illustrated by the authors open re- duction and internal fixation result in early union and more satisfactory outcome and the avoidance of ununited fractures of the medial malleolus —Ed.]

Treatment for Comminuted Fractures of Os Calcis is de scribed by Chester R. Zeiss[9] (Chicago)

TECHNIC.—With the patient supine and under general anesthesia the involved foot, ankle and lower third of the leg are surgically pre pared and draped and the leg is elevated. The insertion of the Achilles tendon at the os calcis is palpated, and a ⅛ in. Steinmann nail is drilled into the os calcis at a 35-degree angle plantarward in its axial plane. The depth of nail penetration is governed by the length of the posterior os calcis fragment as revealed by x ray Usually this is 1 1.5 in. Figure 97 illustrates the Bohler angle and the insertion of the Steinmann nail.

The drill bit is now removed and a sterile gauze dressing 4×4 in., is passed over the nail to firm contact with the skin of the heel The surgeon now faces the plantar surface of the foot. The fingers of the right hand grasp the protruding Steinmann nail as the right thumb is placed on the plantar surface of the heel at the midportion of the os calcis (Fig 98) The fingers of the left hand grasp the dorsum of the foot at the tarsometatarsal junction as the left thumb is placed on the plantar surface of the foot in the midtarsal area

(9) J.A.M.A. 169 79 794 Feb. 21 1959



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(9 J A M A 169 794 Feb 21 1959



Fig 97 —Lateral x-ray of foot showing Böhler angle and angle and depth of insertion of Steinmann nail. (Courtesy of Zeiss, C. R. J.A.M.A. 169 79 794 Feb. 1 1959)



Fig 98 —Position of fingers of right hand grasping Steinmann nail and of right thumb pushing upward on plantar surface of os calcis. (Courtesy of Zeiss, C. R. J.A.M.A. 169 792-794 Feb. 21 1959)

Plantarward lever like traction is applied to the nail and forefoot against the upward thrust of the right thumb because it is used as a fulcrum against the body of the os calcis. Traction and thrust are maintained while an associate places the Bohler os calcis clamp against the medial and lateral surfaces of the os calcis and quickly compresses the sideward spread of the fragments until normal configuration can be palpated and free space is present under the external malleolus. The os calcis clamp must be released quickly to avoid devitalization of the already embarrassed skin. Traction and thrust on the forefoot, nail and os calcis are maintained while the associate encircles *the limb from the toes to the knee with sheet wadding* then plaster Traction is released at separate individual points only mo-



Fig 99—All traction force maintained while plaster hardens. (Courtesy of Zeiss, C. R. J.A.M.A. 169:792-794 Feb. 21 1939)

mentarily to allow for the passage of the sheet wadding and plaster As the plaster is applied it is molded well about the os calcis and nail All traction forces are maintained until the plaster hardens (Fig 99)

Three Cases of Fractures of Clavicle of Radiotherapeutic Origin are reported by J Papillon F Pinet and F Arcardio[1] All were in women who had had radical breast amputations followed by irradiation The spontaneous fractures of the clavicle were discovered respectively 21 9 and 11 years after treatment. None of the patients experienced acute pain that would mark definitely the time of fracture the pain was of insidious onset and was accentuated by pre-existing functional difficulty The bone lesion was only partly responsible for the symptoms which were based on profound sclerosis of sub- and supraclavicular tissues which sometimes even immobilized the bone fragments Associated neurologic signs with a lesion of the brachial plexus in 1 case and severe physiopathic disturbances of the upper arm indicated the degree of involvement of soft tissues both superficial and deep In 2 of the 3 patients there were radiologic signs of "radiotherapeutic lung"

This type of fracture of the clavicle is simply a symptom in a dystrophic complex of all the juxtaclavicular structures and is usually discovered only by x ray examination The fracture line is distinct it is a transverse fracture usually situated in the middle third of the bone It may be accompanied by overlapping of the fragments Neighboring ribs sometimes present alterations with rarefaction of osseous

(1) J radiol. et électrol. 39 764-766, November 1958.

trabeculae and a microgeodic appearance indicating their participation in the dystrophic process

The lesions can be mistakenly diagnosed as a recurrence of the neoplasm and may lead to repeated irradiation aggravating the condition The presence of cutaneous lesions due to radiation should suggest the possibility of associated bone lesions as a cause of pain and indicate the need for radiography

These fractures exhibit a characteristic course, with absence of bony union and dystrophic disturbances in soft tissues The modalities of radiation responsible for the fractures varied sometimes large single doses sometimes repeated always with early skin reactions The dose received by the clavicle in 1 case was over 6,000 r

Treatment is essentially prophylactic by excluding the clavicle in so far as possible from the irradiated area or by protecting it. But the risk of a fractured clavicle cannot be compared with the importance of sterilizing a neoplastic focus The 3 cases of osseous radiodystrophy here reported all had excellent results from the standpoint of the cancer and the radiolesion may be considered as proof of the efficacy of radiation therapy

Traumatic Posterior Dislocations of Shoulder Six Cases Treated in One Year (in 5 patients) are reported by J Piollet J Magne M David and L Pradeau[2]

Man, 52, had had generalized epileptic seizures at age 16-24 after which the seizures apparently had disappeared completely Then suddenly he had a very severe attack with loss of consciousness When he awakened both arms were paralyzed and extremely painful X rays showed a fracture in the median portion of the body of the 6th cervical vertebra bilateral fractures of the humeral tuberosities with abnormal joint morphology and on the left a surgical fracture of the neck. Reduction of the shoulders in plaster produced some relief but not complete cessation of pain Orthopedic reduction under anesthesia was possible on the right but not on the left side. At operation on the left side the humeral head was resected and the luxation was reduced. Recuperation was extremely slow and motility of the arms remained incomplete owing to residual damage to the nerves which had occurred during the first days after injury

Posterior dislocation of the shoulder is a rare lesion representing 1 5-2% of all luxations of this joint It occurs preponderantly in males and always in adults Epilepsy is the cause in 20% and convulsive therapy in 10% Trauma is the

(2) Semaine hôp. Pari 35 888 897 Mar 4 1959

cause in 70% of cases and may be direct or indirect. The displacement occurs in two stages (1) a forced internal rotation causing a posterior subluxation of the humeral head which represents only slight exaggeration of a physiologic mechanism and is reversible (2) hooking of bone at the posterior edge of the glenoid by the anatomic neck or the intertuberosital gutter which makes spontaneous reduction impossible. Posterior luxations of the shoulder are of two types (1) subacromial or infra acromial the most frequent type and (2) sub- or infraspinal in which the head considerably more displaced, is found in the high portion of the subspinal fossa. Capsuloligamental lesions are usually absent. Even muscular lesions are minimal confined to elongation of tendons without rupture Bone lesions are frequent (50% of cases) and usually involve the head of the humerus

The authors cases were classified as pure luxation (1 case) luxation associated with fracture of the lesser tuberosity (1) associated fracture of the lesser tuberosity and part of the humeral head (1) with fracture of the anatomic neck (2) and with fracture of the surgical neck (1) Vasculonerve lesions are exceptional Aside from 1 of the author s cases in which there were multiple bilateral nerve lesions there has been only 1 reported case in which there was circumflex paralysis

Scarcity of symptoms in infra acromial luxations explains the frequency (about 50%) with which these cases are neglected When seen shortly after injury the shoulder appears deformed by edema and hemarthrosis Common symptoms are intense persistent pain absolute functional impotence and marked internal rotation Some weeks later in neglected dislocations diagnosis is easier The early signs mentioned above are still present and rapid deltoid erosion is indicated by an abnormal subacromial anteroexternal depressibility and disappearance of normal retroacromial depressibility In infraspinal types deformity is marked and the diagnosis is evident For radiologic diagnosis profile films are necessary since the anteroposterior view is almost normal The clinical course is marked by rapid aging of the lesions almost pathognomonic persistence of pain and orthopedic irreducibility

In surgical reductions the authors prefer the superoexternal vertical route with stripping of the acromial vault the

transdeltoid articular approach and section of the supraspinatus tendon. In recent luxations, simple orthopedic reduction should be carried out under general anesthesia regardless of fractures; these, however, may make orthopedic treatment impossible, necessitating immediate surgical treatment. Attempted orthopedic reduction of old dislocations usually fails (failed in 5 of the author's 6 cases) and open reduction is necessary.

Suspension Cast for Acromioclavicular Separations and Clavicular Fractures is described by Sam G. Stubbins and W. H. McGaw[3] (St. Luke's Hosp., Cleveland).

METHOD.—A loose fitting jacket (Fig. 100) is applied smoothly with appropriate padding over the chest. It is best molded fairly close under the pectoral muscles on the affected side (Fig. 101, *A*). The jacket should extend just past the xiphoid process in front and can be lower behind but should not reach the iliac crests; it need not be bulky or heavy. At least two straps are incorporated within the cast



Fig. 100.—Suspension cast for acromioclavicular separation in man, 37. (Courtesy of Stubbins, S. G., and McGaw, W. H.: J.A.M.A. 169:672-675, Feb. 14, 1959.)

(*C*). These straps emerge from the superior edge of the cast so that they meet in front at a buckle where the patient when lying down can easily adjust them. They are so located that the two parts hang almost straight down from the outer end of the clavicle. Often it is advisable to put in another pair of straps and another buckle so that they may cross or spread out, thus allowing finer adjustments of pressure. This prevents the straps from slipping off the shoulder or, in case of a fractured clavicle, permits added pressure to be applied over the proximal fragment where desired. A piece of soft sponge is fashioned to fit under the straps. It is cupped to prevent point-skin irritation

(3) J.A.M.A. 169:672-675, Feb. 14, 1959.

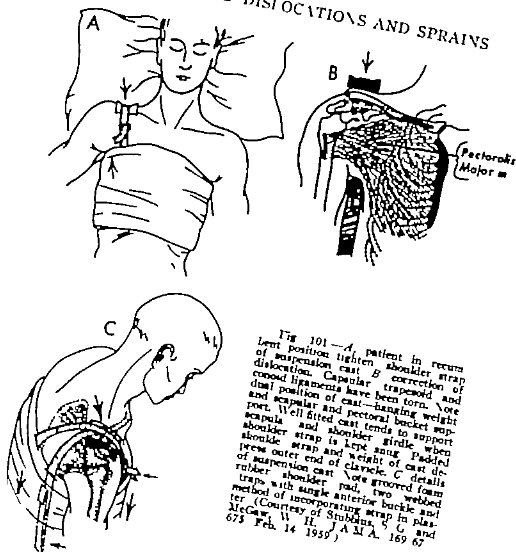


Fig 101—*A*, patient in recumbent position tighten shoulder strap of suspension cast *B* correction of dislocation. Capsular trapezoid and conoid ligaments have been torn. Note dual position of cast—hanging weight and scapular and pectoral bucket support. Well fitted cast tends to support scapula and shoulder girdle when shoulder strap is kept snug Padded shoulde strap and weight of cast depress outer end of clavicle. *C* details of suspension cast Note grooved foam rubber shoulder pad, two webbed traps with single anterior buckle and method of incorporating strap in plaster (Courtesy of Stubbins, S G and McGaw, W H, J A M A 169 675 Feb. 14 1959)

(*A-C*) Molding of the rubber pad also permits control of pressure e g., if there is a posterior displacement of the clavicular end, the pad can be placed and adjusted so that the maximum pressure is exerted along the posterior edge of the clavicle instead of just along its superior surface (*C*)

Treatment for acute acromioclavicular dislocations with the loose, suspension cast obviates many of the disadvantages common with other methods The method described uses the principle of gravity when the patient is upright and the principle of gentle pressure and counterpressure when he is lying in bed It is not necessary to immobilize the whole arm if the patient is intelligent and cooperative enough to tighten

the shoulder straps on lying down Conventional clothes can be comfortably worn during the entire 5-6 weeks of treatment

Excellent cosmetic and functional results were obtained with this method in 18 patients with acromioclavicular separation and in 5 with clavicular fractures No patients with acromioclavicular separation needed further surgery or treatment No clavicular fractures showed nonunion All of the patients had a normal painless range of motion in the shoulders and elbows

Fracture Dislocation of Shoulder is uncommon. Typically such a fracture is comminuted, with four fragments being produced the detached head of the humerus the greater tuberosity the lesser tuberosity and the shaft of the humerus *The rotator muscles remain attached to the tuberosities* which are joined to the humeral shaft by soft tissue attachments on their lateral surfaces so that their blood supply is



Fig 102 (left) —Original injury
Fig 103 (right) —Twenty month fter excision f head fragment.
(Courtesy of Kugler M Guy s Hosp. Rep. 108 63-71 1959)

assured The head fragmer er becomes completely or nearly detached and is lik ergo ischemic necrosis

Micl l Kugler[4] reports all 3 patients the ana

toi l head was f e *the capsule in front*

an ithout soft ti ments 02) In

eac rn capsule but n t was

ma tuberositie All p arted

(4 108 63 71 1

shoulder exercises immediately after operation, yet firm bony union occurred between tuberosities and shaft (Fig 103)

No method of treatment of fracture-dislocation of the shoulder is uniformly satisfactory Closed reduction is often unsuccessful, and open reduction frequently leads to avascular necrosis of the replaced head fragment Removal of the humeral head is probably the commonest treatment Its results are only fair At first the shoulder is flail but increasing fibrosis with stiffness develops later The final active abduction range is seldom above 90 degrees, and rotation is generally severely limited There is also a variable amount of residual pain

Poor function after removal of the displaced head fragment and late pain have led various surgeons to attempt replacement by an endoprosthesis Some results have been good, others poor The small rotator muscles must be firmly attached to the prosthesis if good function is to be expected

Some Comments on Treatment of Fractures of Long Bones in Children (3,594 Cases) are presented by J Desbrosses J Reboullat Cl. Bosser and M Guilleminet[5] (Lyons) Fractures of the arm were most numerous (2,742 cases) The mechanism of fracture is almost always indirect, as when the child extends his arms to break a fall The bony segments are proportionally longer than in the adult and less well padded with muscles which increases fragility Fragility is also enhanced by still-developing connecting cartilage creating zones of less resistance near the joints where lines of force diverge.

Fracture of the forearm occurred in 1 364 cases involving both bones in 824 the radius in 472 the cubitus alone in 48 and fracture of the ulnar shaft with dislocation of the head of the radius in 20 (Monteggia s fracture) There were 797 fractures of the elbow, 202 of the humerus and 379 of the clavicle. The lower extremities are considerably less vulnerable of 852 fractures 368 involved the femur 443 both bones of the lower leg 4 the tibial plate and 37 were uni or bimalleolar

Most of these fractures were reduced satisfactorily by orthopedic methods under general anesthesia with radiographic control in complex fractures Surgery was used in

(5) Presse méd. 66 1929-1930 Dec. 6, 1958

340 cases (9 4%) Indications for surgery were more frequent in fractures of the upper extremity especially at the elbow Supracondylar and external condylar fractures present the greatest risk of immediate local complications—lesions of the radial, cubital or median nerves contusion or rupture of the humeral artery with consequent vasomotor disorders and large compressive hematomas These complications may also cause serious secondary orthopedic sequelae Of 797 fractures of the elbow 147 (18 3%) were operated on operations were performed in 86 (19%) of 452 supracondylar fractures The usual technic was a U shaped posterior incision isolation of the cubital nerve section of the bicipital tendon and reduction under vision with fixation by clamps or pins (68 cases) 15 were reduced without such fixation. Of 126 fractures of the external condyle 32 (25%) were reduced surgically In some forearm fractures surgical reduction was necessary to obtain or maintain perfect reduction. Osteosyntheses of all types were used in 67 fractures (7%) involving both bones in 11 of the radial diaphysis (17 5%) 7 Monteggia fractures (35%) but only 1 (2.3%) of the lower end of the radius Only 1 open reduction was necessary in 115 cases of diaphysial fracture of the humerus (0.9%) In cases with displacement of the head of the humerus after fracture of the neck operation often without artificial fixation was necessary in 23 (27%)

Surgical reductions were necessary in only 7.7% of fractures of the lower extremities There were 40 operations (11%) in 364 cases of fracture of the femoral diaphysis All fractures of the ends of the tibias were treated orthopedically while only 24 fractures of the tibial diaphysis of 443 (5 4%) required nailing

In general orthopedic reduction should be attempted first in children for it is usually successful However surgical treatment may be required in certain cases for a satisfactory result

Fractures of Elbow in Children require special attention according to Lawrence Crane[6] (Portland) because of the many epiphysial centers in the elbow which make interpretation of x rays difficult the growth disturbances that occasionally occur with these fractures and the possibility of

(6) J M Inc M A. 50 9-15 January 1939

circulatory damage which occasionally follows fractures A fracture of the capitulum if it is displaced should be openly reduced It can be held with a nail (Figs 104 and 105) or with silk or catgut The degree of displacement in Figure 104 might have been satisfactorily corrected without



Fig. 104 (left) —Capitular fracture involving most of lateral condyle in boy aged 14.
Fig 105 (right) —Two years after open reduction
(Courtesy of Crane, L. J Maine M A. 50 9-15 January 1959)

an open reduction, but the procedure prevented further separation and allowed early active motion.

Fractures of the medial epicondyle associated with dislocation or subluxation may quite often require open reduction Gentle manipulation under general anesthesia is usually indicated as the primary treatment but if this is unsuccessful an open reduction should be done immediately The medial epicondyle can usually be removed from the elbow without difficulty and tacked with suture or pin in its normal position

Supracondylar fractures do not usually require open reduction. They may however be extremely difficult to re-

SUMMARY OF TREATMENT METHODS USED

Method	No.	Result	
Closed manipulation	2	Failed	2
Operative reduction	5	Good	4
		Failed	1
Primary excision	4	Good	4
Secondary excision	1	Good	1

Larger fragments probably require internal fixation This may take considerable ingenuity to avoid extensive dissection and further damage to the blood supply or injury to the articular surfaces

Irrespective of the method of primary treatment the after care must be well supervised. Plaster immobilization should be minimized to cover the short period necessary for soft tissue healing after excision and a slightly longer period should be allowed when internal fixation is necessary In 4 patients the pins were removed and exercises started after several weeks Serious permanent stiffness is not likely to be a problem except when extensive soft tissue injuries to the capsule and related structures have occurred

Fractures of Radius and Ulna Incidence, Technic of Closed Reduction and Management in 631 Cases are described by K. S Bose[9] *(Calcutta)*

TECHNIC—Under general anesthesia, vertical traction was applied by an assistant for about 5 minutes by holding the patient's thumb in one hand and the index, middle and ring fingers with the other hand. During traction care was taken that the elbow was free from the table In adults, some counter traction at the elbow by downward push on the arm was often necessary To aid reduction, a tense forearm was lightly massaged by effleurage to disperse hematoma. Rotation of the forearm was adjusted during traction depending on the fracture sites. Fractures in the upper third of the bones above the insertion of the pronator teres needed comfortable but not forced supination. For fractures below the insertion of the pronator teres, mid prone position of the forearm was accepted. For fractures of the lower third, complete pronation and ulnar deviation with slight flexion of the wrist were used. Manipulation of fragments was done by angulatory method to hitch them together by palpation.

Before plaster was applied, the shape and length of the forearm were checked by observing the level of the radial and ulnar styloid processes, by disappearance of crepitation between fragments on palpation in transverse axis and by stability of fragments in longitudinal axis. Vertical position of the forearm was helpful in assessing the angulation. *Palpation of the subcutaneous border of the ulna was helpful* in detecting the rotational and overriding displacement. Some-

(9) Indian J Surg 21 83 87 February 1959

times stability of fragments was not secured and required pressure and careful holding during setting of the plaster When there was soft tissue interposition crepitus disappeared without simultaneous stability being attained.

Plaster immobilization extended from the upper arm just above the insertion of the deltoid to the knuckles. A dorsal cast and a short volar cast, completed by circular turns of plaster bandages were used. A thin layer of cotton was used as padding A squeezing grip with the thumb pressing between the bones of the forearm was used to keep the integrity of the interosseus space The plaster casing was molded into an oval cross-section to fit the forearm. The thumb was included up to the 1st interphalangeal joint and kept in anatomic forward plane to prevent late collapse of radial fragments, especially in lower-third fractures.

Active exercises of the fingers were encouraged as well as movements of the shoulder especially rotation and abduction. Apposition of the thumb and flexion of other fingers were made full and free. A sling was used as a support. The period of immobilization depended on the patient's age and was maintained until clinical union was attained.

The success of management depended among other things on the patient's age (table)

PERCENTAGE OF SUCCESS WITH REGARD TO AGE

Below 10 yr	100%
11 20 yr	96%
Over 20 yr	45%

Surgical Treatment of Certain Cases of Distal Radial Fracture [Colles Fracture] In this type of fracture there are always some cases which resist conservative treatment Either the fragments cannot be reduced properly or it is difficult to maintain the reduction in a plaster cast, even after reduction has been tried several times

H Willenegger and A Guggenbuhl[1] (County Hosp Liestal Switzerland) tried first after successful reduction but failure in the plaster cast to secure the results of a repeated reduction by using a transcutaneous transfixion pin Later without waiting for a failure in the cast, transcutaneous transfixion was applied immediately after a successful closed manipulation (Fig 109)

This technic was used in 27 patients All were available for follow up 2-8 years after the osteosynthesis In 12 the secondary nailing was done after several failures with conservative treatment in plaster casts The interval between fracture and osteosynthesis was 1 12 days (average 4 days)

(1) Helvet chir acta 6 81 94 June, 1959

Except for a girl aged 5 the patients were aged 19 53 years (average 36 years) In 15 osteosynthesis was the primary procedure It had to be performed because even a slight slackening of traction led to a disalignment of the otherwise well reduced fragments This group consisted mainly of elderly persons aged 60-81

Transcutaneous transfixion is especially indicated when the epiphysis is broken off as a whole If reduction is suc

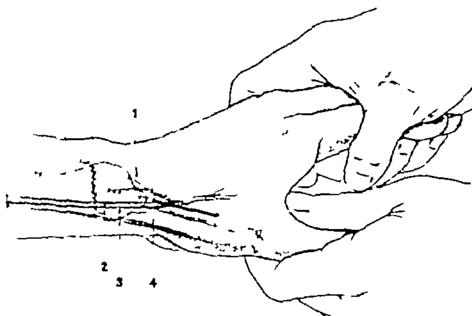


Fig 109 (Courtesy of Willenegger H. and Guggenbuhl, A. Hel et. chir acta 26 81 94 June, 1959)

cessful but cannot be maintained in a plaster cast percutaneous osteosynthesis with a transfixion pin is a simple and reliable procedure. In multiple fractures transfixion osteosynthesis is successful only if the main fragment lies radially and the percutaneous fixation of this fragment suffices for good reduction This method is not indicated in complicated comminuted fractures with many fragments none of which are of the right size or shape for transfixion

► [I personally have used this method of a transfixion wire for securing Colles' fractures particularly the unstable ones, and have found it most satisfactory Other fractures are treated by a transfixion pin method in my hands, thus one is no exception to the rule.—Ed.]

Treatment of Fresh Fractures of Carpal Scaphoid Sten Wallensten Ruben Cronestrand and Håkan Lugnegård[2] *(Stockholm) group fractures of the carpal scaphoid accord*

(2) Acta chir scandina 116 148 154 1958-59

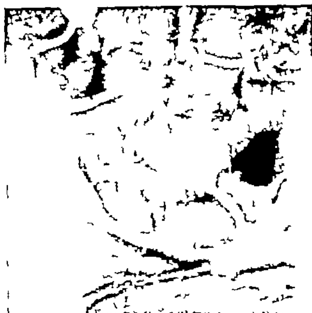


Fig. 110.—Fresh fracture through "waist," type 3 in youth, 18, with fractu of carpal scaphold in right hand. (Courtesy of Wallenstein, S., et al.: Acta hir scandina 116:148-154 1958-59.)



Fig. 111.—After 4½ month immobilization, fracture largely filled with callus. (Courtesy of Wallenstein, S., et l Acta chir scandinav 116:148-154 1958-59.)

ing to their anatomic position in relation to entry of the blood vessel into the bone tubercle fractures those where the fracture line is in the so-called waist and those where the fracture line is proximal to the so-called waist

The authors reviewed data on 62 consecutive fresh fractures of the carpal scaphoid in the wrist (types 2 and 3) The term 'fresh fractures includes all those in which there was an untreated injury that had occurred not more than 2 months before the first visit to the clinic Distribution of the cases according to the length of time before the first treatment is shown in Table 1

All the fractures were treated with a circular plaster which extended from just below the elbow joint to the meta

TABLE 1—AGE OF FRACTURE OF CARPAL SCAPHOID ON FIRST HOSPITAL VISIT

Age of Fracture	No. of Patients
3 days	45
3—6 days	6
7 days	11
Total	62

TABLE 2.—PERIOD OF IMMOBILIZATION IN PLASTER AND LENGTH OF TREATMENT FOR 62 PATIENTS WITH CARPAL SCAPHOID FRACTURE

No. of Weeks	Immobilization in Plaster	Total Length of Treatment
	No. of Patients	No. of Patients
6	2	2
6— 8	9	2
8—10	11	7
10—12	12	10
12—15	12	12
15—20	10	13
20	6	16
Total	62	62

carpal head in the hand except for the thumb which was covered up to the distal interphalangeal joint. The patients were checked by x rays every 4-5 weeks after removal of the plaster The plaster was not removed until the fracture had filled with new bone or become invisible by x rays Every fracture united and no pseudarthrosis developed.

Immobilization in the plaster varied from 36 to 345 days Average period of immobilization was 92 days and average total length of treatment before final discharge was 118 days Table 2 shows the period of immobilization in plaster and

total length of treatment before the patient was allowed to resume work. Only 2 fractures healed in less than 6 weeks in a plaster cast. Thus the fracture should be immobilized in plaster for at least 6 weeks before the first x rays are taken The chances for healing of a fracture in a shorter period are minimal and manipulation of the wrist without the cast dur-

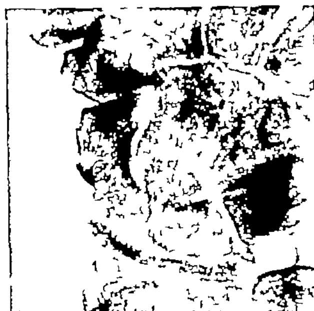


Fig 112—After 5½ months immobilization, fracture healed and fracture line not discernible. (Courtesy of Wallensten, S. et al Acta chir scandinav 116 148-154 1958-59)

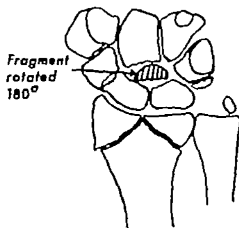
ing the examination can be deleterious to union when the fracture has not yet healed

A disturbance of the union process not infrequently occurs in fractures of the carpal scaphoid. This appears in the form of an incipient sclerosis of the fracture surfaces and is considered by certain authors to be an indication for surgery This disturbance is not always unfavorable to union and in certain types of these fractures it may perhaps be regarded as a physiologic phenomenon The development of sclerotic fracture surfaces can be traced in Figures 110-112, but the fracture healed after 5½ months of immobilization X rays 2 years later showed the carpal scaphoid to be normal with no traces of the fracture. There were 2 other instances of this type in the study material These fractures heal if immobilization in the plaster is adequate.

► [The important factor in treatment of a fresh fracture of the carposcaphoid is the early recognition that such an injury has occurred. Too

often the patient will be told he has "just sprained his wrist" only to have the doctor find to his chagrin 3 or 4 weeks later that the patient is still complaining and that repeat x rays show a carposcaphoid fracture. Any young patient who injures the wrist should have a repeat x ray 10 days after the injury if the symptoms persist. A three fourths view frequently shows the fracture present when the ordinary anteroposterior and lateral x ray at the time of the original injury did not show the damage to the carposcaphoid. Prolonged immobilization often results in a union of the fracture and is to be preferred to bone grafting for care of the ununited fracture of the carposcaphoid.—Ed.]

Naviculocapitate Fracture Syndrome Albert P Marsh and Peter J Lampros[3] (Brooklyn Hosp) state that when force is applied to the wrist in appropriate direction the waist of the navicular impinges on the radial styloid causing fracture of the navicular at its most vulnerable spot If the force is sufficient the proximal head of the capitate will be in



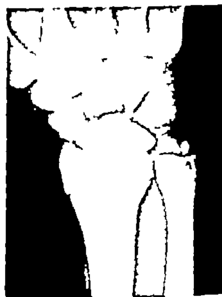


Fig 113 (left) Appearance of fracture fragments with 180 degree rotation of proximal head of capitate

Fig 114 (right) —Naviculocapitate fracture syndrome with associated fractures of radius, ulna and triquetrum.

(Courtesy of Marsh A P and Lampros, P J Am. J Roentgenol 82 255-256, August, 1959)

cluded in the line of force causing fracture with subsequent 180-degree rotation of the proximal capitate fragment (Fig 113) The x ray (Fig 114) may be confusing if the mechanism of injury is not appreciated

Since the blood supply to the capitate enters its distal portion the proximal rotated fragment is avascular and will be

(3) Am J Roentgenol 82 255 256 August 1959

come necrotic. The preferred method of treatment is excision of the fragment This is relatively simple since the fragment usually lies free in the joint. Prolonged rigid immobilization is required for the accompanying navicular injury

In a case reported by the authors besides all the features of the naviculocapitate fracture syndrome there were associated fractures of the triquetrum radius and ulnar styloid.

Man, 22, injured his right hand and wrist but was unable to recall the mechanism of injury X rays showed fractures of the radius ulna navicular capitate and triquetrum (Fig 114) Initially the naviculocapitate syndrome was not recognized, and a cast was applied. When the patient returned in 1 month the navicular showed evidence of repair but the proximal capitate fragment was becoming necrotic. Since the navicular was healing it was decided not to operate for fear of disturbing its blood supply The capitate fragment was to be removed later but the patient did not return for further care.

Treatment of Acutely Compressed Vertebral Body by Immediate Progressive Mobilization. In prevalent practice acute compression fractures of the vertebrae are treated for varying periods in hyperextension casts and back braces without reduction Though over all results are good significant residual sociosomatic complaints occur Such complaints from back injuries are believed to arise in direct relation to the length of treatment. Ernst Dehne and James J Schubert[4] (Letterman Army Hosp, San Francisco) describe a method of treatment in which the time factor is substantially reduced and functional results are excellent

METHOD.—With the patient at strict bed rest, he practices rolling from one side to the other as soon after the injury as possible, usually within the first 2 days Return of muscle function of the affected area is announced by disappearance of pain. The patient s future progress is regulated by permitting any function that can be carried out without recurrence of pain. Ambulation, at first in limited periods and distances is resumed within a few days after the injury Tolerance for prolonged sitting or standing is much slower to return, so these activities are restricted during the early weeks of convalescence.

Results of treatment in 35 patients with compressed vertebral fractures are shown in the table. In 23 immediate progressive mobilization was used In 12 initial treatment was begun elsewhere by hyperextension body cast. No patients with compression fractures resulting from osteoporosis or electric shock therapy are included in this study Average period of bed rest for the 23 patients treated by imme-

(4) U S Armed Forces M J 9 1736-1744 December 1958.

Duration of Treatment in Patients with Compressed Vertebral Fractures

Treatment	No. of Patients	Average Age (Yrs.)	Avg. Time (Days) In Cast	In Brace	At Bed Rest	Total Average Treatment Time (Days)
Hyperextension jackets	12	26	57	120	—	177
Immediate mobilization	23	41	—	—	10	18

diate progressive mobilization was 10 days They returned to duty on the average 18 days after the injury All were free from pain with normal range of motion None manifested neuropathy during treatment Activities were restricted for 3-6 months Follow up x rays showed no increase in anterior compression of the involved vertebrae Patients treated in casts were in plaster for an average of 57 days An additional 10 days on the average were required to rehabilitate the patient sufficiently for return to duty

Pseudosubluxation of Axis in Children Children are frequently seen in whom a lateral film of the cervical spine after injury to the neck shows an anterior displacement of the axis on the 3d cervical vertebra This finding has often been misinterpreted as representing a true traumatic dislocation with the result that the patients have been subjected to prolonged and unnecessary treatment George Jacobson and H Harlan Bleecker[5] found records of 10 such cases in the files of the Los Angeles County Hospital during 1950-56 (Figs 115-119) All patients were children aged 4-6

Before about age 10 flexion and extension of the cervical spine are centered at the 2d and 3d cervical vertebrae. With flexion angulation occurs at the 2d and 3d cervical level In addition the relatively horizontal plane of the articular facets and the apparent laxity of the intervertebral ligaments permit a gliding anteroposterior motion between these two vertebrae This may vary from little or no forward displacement to several millimeters (Fig 118) With extension the anterior displacement of the atlas disappears (Fig 119) as does the angulation Since only minimal flexion of the head may be sufficient to produce an apparent deformity careful placing of the head and neck in true neutral position

(5) Am. J Roentgenol 82 472-481 September 1959



Fig 115 (above left) —Anterior displacement of 3 mm. of 2d on 3d cervical vertebra with considerable angulation at this level in girl, age 6, 1 day after minor injury. Note head and neck are acutely flexed.

Fig 116 (above) —Recurrence of slight anterior displacement of 2d cervical vertebra, 8 months later after removal of Minerva jacket. Again head is slightly flexed.

Fig 117 (left) —After reduction by traction patient again placed in cast. Note that now however head is held in true neutral position. Immobilized 20 months.

(Courtesy of Jacobson, G., and Bleecker, H. H. Am. J Roentgenol. 82 472-481 September 1959)

is important during roentgenography At about age 10 the apex of the flexion curve shifts downward to the 4th and 5th or 5th and 6th cervical level where it remains The authors have not observed forward gliding of the 2d on the 3d cervical vertebrae in normal older persons though a steplike offset may occur at lower levels

► [These authors obtained x rays of the cervical spine of 100 normal children, aged 2 14 selected at random from those given general physical examinations. Lateral x rays were made with the head in flexion and then in extension. They found that 15 of these children, 8 boys and 7 girls demonstrated a hypermobility between the 2d and 3d cervical vertebrae

with 2 presenting a hypermobility between the 3d and 4th cervical vertebrae. They pointed out that subluxation of cervical vertebrae can occur and not be associated with fracture. Three types are recognized—the atlantoaxial, suboccipital and rotary unilateral subluxation below the 2d cervical vertebrae. In true dislocations pain, torticollis, muscle spasm and



Fig 118 (left) Head and neck flexed in normal boy, age 3 Atlas is displaced anteriorly 3 mm. Apex of curvature is at 2d to 3d cervical level.
Fig 119 (right) —With extension anterior displacement of atlas disappears, and posterior border of vertebra forms smooth concave surface.
(Courtesy of Jacobson G. and Bleecker H H Am. J Roentgenol. 83 472-481 September 1959)

limitation of motion are always present The hypermobile vertebrae in children is frequently enough encountered to be confusing, and unless the roentgenographic interpretation is confirmed by the physical signs over treatment by means of prolonged traction or immobilization in a cast may be carried out under the misconception that serious injury exists —Ed)

Advantages of Early Spine Fusion in Treatment of Fracture-Dislocation of Cervical Spine H Francis Forsyth Eben Alexander Jr Courtland Davis Jr and Robert Underdal[6] (Bowman Gray School of Medicine) report results in treatment of 81 patients There were injuries of the 1st or 2d cervical vertebra in 23 patients and injuries below the 2d in 58 (table)

If 3 patients in whom fusion was done after trial of conservative treatment (and who were therefore counted in both the fusion and nonfusion group) are included there were 38 patients treated by internal fixation and spine fusion

(6) J Bone & Joint Surg. 41 A 17-36, January 1959

Type of Bone Lesion By Roentgenographic Appearance	Type of Injury: Fusion (35 Cases), With Neurological Changes (23 Cases)	Fusion (35 Cases), Without Neurological Changes (13 Cases)	Non-Fusion (46 Cases), With Neurological Changes (20 Cases)	Non-Fusion (46 Cases), Without Neurological Changes (1 Cases)
Total C1 and C2	6	10	3	4
Total below C2	10	3	20	13
Fracture of odontoid	5	6	2	2
Dislocation of C1 on C2 (torn transverse ligament)	1	2	0	0
Dislocation without fracture (unilateral)	2	0	1	0
Dislocation without fracture (bilateral)	0	1	0	1
Compression fracture of body only	0	0	5	4
Rotatory fracture-dislocation with unilateral facet fracture	3	1	2	[illegible]
Anterior fracture-dislocation with bilateral facet fractures	12	2	11	5
Fractured small parts only (pedicles, laminae, spines)	0	1	0	4
Chip fracture of body or anterior longitudinal ligament tear	0	0	6	0
No bone lesion by x-ray	0	0	2	0

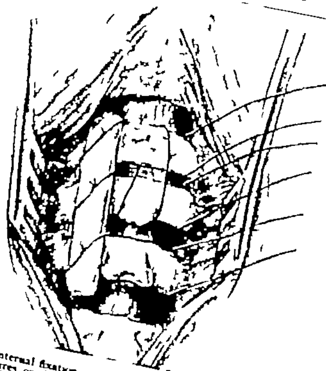


Fig 120 —Type of internal fixation and spine fusion used for f actures of odontoid process and other fractures or dislocation of atlas and axis. (Courtesy of Forsyth, H F et al J Bone & Joint Su g 41 A 17 36 January 1959)

and 46 treated by other methods The major factor that determined results in most patients was neurologic change. Neurologic changes were present in 23 patients in the fusion group Twelve recovered completely 6 improved 4 did not improve and outcome was unknown in 1 In the nonfusion group 29 had neurologic changes Seven recovered completely, 10 improved 6 did not improve and outcome was unknown in 6 Patients in whom fusion was done had less residual deformity a lower rate of recurrence less time in the hospital or in casts and less time away from work



Fig 121 —Lines of force in extension injury with posterior dislocation of 4th on 5th cervical vertebra with rupture of anterior longitudinal ligament, separation between vertebral body and cartilaginous end plate stripping of posterior ligament away from lower vertebrae and carrying of spinal cord backward against sharp leading edge of lamina of subjacent vertebra. (Courtesy of Forsyth, H. F., et al J Bone & Joint Surg 41 A 17 36, January 1959)

When operation is performed it is usually done as soon as the patient's general condition permits Where indicated, a hemilaminectomy is done to inspect and decompress the cord or to look for a ruptured disk or for a bone fragment that is causing persistent pressure If complete reduction of the fracture dislocation has not been obtained by traction it can be done under direct vision Internal fixation is then accomplished with 20-gauge stainless steel wire. In fractures below the axis the spinous processes of 3 vertebrae are usually

wired together After a bone graft is placed underneath them against the spinous processes the wires are tightened by twisting until they are snug and the whole group is stable. More bone grafts in the form of matchsticks are added to the fusion area extending laterally over the laminae and posterior articulations on both sides The operative procedure

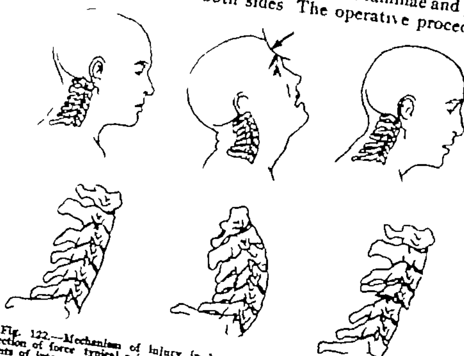


Fig. 122.—Mechanism of injury in hyperextension fracture-dislocation showing direction of force typical points of fracture and final position of fractured vertebra. Points of interest are anterior displacement of 4th on 5th cervical vertebra and upward compression of inferior articular process of 4th cervical vertebra and its spinous processes. (Courtesy of Forsyth, H. F., et al: J Bone & Joint Surg 41 A 17 36 January 1959)

for fracture of the odontoid process or tear of the transverse ligament with atlantoaxial dislocation involves wiring and fusing the first 3 cervical vertebrae (Fig 120)

The mechanism of injury in cervical fractures and dislocations is important especially in the hyperextension types (Figs 121 123) A new interpretation of the x ray findings in a large group of fracture-dislocations with mild anterior displacement showed that about half were caused by hyper extension rather than by flexion as was previously thought. Before recognition of this mechanism it was difficult to understand the severe neurologic changes that were often present Placement of these cases in the group of hyperextension injuries makes the neurologic damage understandable

► [The advantage of an early cervical spine fusion in case of a fracture

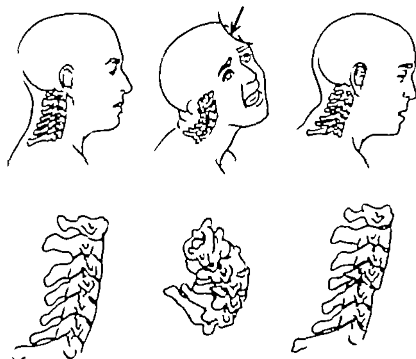


Fig 123—Mechanism of injury in rotatory hyperextension fracture-dislocation showing direction of force, typical point of fracture and final position of fractured vertebra. Besides slight anterior displacement and rotation of body of 4th cervical vertebra, it is important to note horizontally displaced inferior articular process on one side of 4th cervical vertebra. This horizontal articular process occurs on side away from point of injury and I invariably inferior articular process of upper or displaced vertebra. (Courtesy of Forsyth, H. F., *et al* J Bone & Joint Surg. 41 A: 17 36, January 1959)

dislocation with an unstable cervical spine has recently been brought rather forcibly to my attention. A patient injured in 1941 suffered a fracture of the 5th cervical vertebra At the time of the injury he had a complete paralysis of all extremities and in all essentials had permanent quadriplegia. However a full recovery was made except for the presence of a left foot drop. There was no progression of his symptoms until approximately 18 years later when he began to develop pyramidal tract signs with a spastic left hemiplegia due to instability of the cervical vertebra. A fusion operation was carried out after investigation of the spinal canal showed a free flowing of contrast medium through the cervical spinal canal area. I am sure this patient would have been better treated by a primary cervical spine fusion at the time of the original injury—Ed]

Fusions of Cervical Spine may be done by the anterior approach from the level between the 2d and 3d cervical vertebrae down through the 7th cervical and 1st thoracic vertebrae Fusion through the posterior approach may be performed all the way from the skull to the thoracic vertebrae including all or any combination of cervical vertebrae that may be desired The two important indications for fus

ing the cervical spine according to Robert A Robinson [7] are to prevent mechanical irritation of important neural and vascular tissue at sites of bony spur formation between two vertebrae and to maintain the normal dimensions of the various bone canals in the cervical spine when instability between cervical vertebrae tends to constrict these canals

In many patients with symptoms due to compression or irritation of nerve roots or the vertebral arteries by bone spurs conservative treatment proves effective. Occasionally however in a patient in the later decades the pain becomes intractable despite traction rest and adequate external fixation. In such a situation spine fusion may be indicated with or without excision of the posterior articulations at the intervertebral levels determined to be involved by the offending osteophytes

A few months after extensive laminectomy and excision of posterior articulations neck pain is not an unusual complication. There is distortion of the normal smooth curve of the cervical spine in flexion and extension as noted in lateral x rays made with the patient standing Cervical spine fusion is indicated in these instances

A high proportion of cervical spine injuries result in instability whereby preservation of the lumen of the vertebral canal is no longer assured regardless of whether or not complete reduction of the fracture-dislocation has been effected by skull traction or any other means Early stabilization may be achieved in such patients by posterior fixation and fusion of the involved laminae and spinous processes

Other indications for fusion of the cervical spine include tuberculosis certain neoplasms of the spine that threaten stability and the flail neck noted in patients surviving respiratory paralysis due to poliomyelitis

The timing anesthesia and approach should be considered carefully before cervical fusion X ray control in the operating room is often essential and always desirable. If the fusion is to be performed under general anesthesia for an unstable fracture or dislocation or for severe osteoarthritis it is mandatory that during intubation neither flexion nor extension of the neck be permitted Nasal intubation is therefore advised When there is doubt about the stability of the spine and

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[7] Bone & Joint Surg 41 A 1-6, January 1959

when for this reason the patient's muscle control of the neck is desirable during fusion it is best to do the fusion posteriorly under local anesthesia if the patient can tolerate it.

► [Of late there has been a great deal of interest in fusion of the cervical spine by the anterior approach. Recently we have had occasion to do a number of these and indeed the operation is much simpler than by a posterior approach and far less discomforting to the patients. The exposure, although more exacting anatomically, is quite easy and the fusion can be performed with a minimum amount of trauma. The subsequent course of these patients has been more gratifying and less trying than in those in whom the posterior approach is used. During the exposure of the vertebral bodies one must be careful to protect the carotid artery and other vital anatomic structures such as the recurrent laryngeal nerve, and in the retraction of soft parts it is advisable to release the traction on the internal carotid artery at least every 10 minutes to prevent damage by loss of blood supply to the brain during the operative procedure.—Ed.]

On Spinal Cord Injuries. Edgar A. Kahn[8] points out that it is now generally agreed that patients with fracture dislocation of the cervical spine, whether the spinal cord is or is not involved, should be placed immediately in skeletal traction. If after reduction or partial reduction of a fracture dislocation of the cervical spine paralysis is absent and instability persists, treatment should be aimed at preventing late or further cord damage by stabilizing the cervical spine through internal fixation and fusion.

The syndrome of acute central cervical cord injury as described by Schneider is being recognized more and more frequently in older persons who have had a hyperextension injury of the cervical spine but who show no evidence of fracture dislocation. The syndrome is characterized by paralysis of the hands, weakness of the arms and sphincter disturbances, but the patient still has some use of the lower extremities. Prognosis depends on whether or not the concentration of the force centrally in the cord has resulted in true structural damage or merely concussion or edema. In absence of a manometric block, which might indicate an extruded intervertebral disk, surgery is contraindicated in patients with this syndrome.

If after injury paralysis is immediate, complete and lasts 24 hours, function of the spinal cord will not return. If the vertebral malalignment in the cervical region is corrected, nothing can be accomplished by open operation. If pressure is brought to bear on the surgeon by the patient or his relatives for laminectomy, he can hardly refuse operation

(8) J. Bone & Joint Surg. 41-A: 6-11, January, 1959.

though he should stress that reduction of the dislocation has achieved all that laminectomy could accomplish

It is in incomplete lesions of the cervical spinal cord that the question of laminectomy is so highly debatable If the lesion is incomplete and realignment of the vertebral column has been accomplished laminectomy is advisable if the paralysis does not improve. However the operation should be performed only after the patient s general condition has stabilized There are two disadvantages in operating on incomplete lesions of the spinal cord. (1) The unskilled surgeon in exposing a displaced and compromised spinal cord may eliminate any chance for future improvement in function by a false move (2) Laminectomy further increases the instability of the cervical spine but anterior fusion can always be carried out later via lateral approach to the vertebral bodies

When the conus medullaris is damaged by acute bone compression as evinced by complete saddle anesthesia loss of sphincter control and absent ankle reflexes recovery of the conus does not occur In spine fractures in the region of the 12th thoracic and the lumbar vertebrae a pure conus lesion is rare because paralysis of the lower extremities is the usual result Such paralysis is ordinarily not caused by spinal cord involvement but rather by damage to the cauda equina In view of the resistance of the cauda equina to trauma most neurosurgeons would want the fracture site explored in the hope that the patient would be able to walk again unless a technically excellent lumbar myelogram showed no abnormal encroachment on the spinal canal.

Injuries to Cervical Cord Fundamental Factors in Treatment and Rehabilitation are evaluated by James C White.[9] The first essential is to protect all patients with injuries to the cervical vertebrae against increasing damage to the spinal cord which may not at first be irrevocably contused or even seriously damaged This requires prompt recognition of a fracture or dislocation. During transportation the head and cervical spine must be stabilized with extreme care. On arrival in the hospital emergency ward complete stability may be maintained by applying a turnbuckle extension collar X rays in anteroposterior and lateral positions together with open mouth views of the odontoid process can be made without removing this protective device. The next step is

(9) J Bone & Joint Surg. 41 A 11 15 January 1959

to apply cranial traction This should be done on every quadriplegic even if no fracture or dislocation is visible in the x rays

Once in traction the patient is safe for turning which must be done hourly around the clock An inlying Foley catheter is inserted to prevent bladder distention Tracheostomy should be performed if indicated and oxygen should be administered Only intravenous fluids should be given for the first few days to reduce gas formation in the intestines

If obvious dislocation cannot be corrected by traction surgery is advisable when paralysis continues to increase and when lumbar puncture demonstrates a complete dynamic block The site of a spinal lesion due to external missile wounds also should be explored Surgery is more likely to do harm than good if undertaken too early in the period of threatening respiratory failure or in the absence of positive *evidence of continued compression by vertebral fracture* or dislocation prolapse of disk tissue or swelling of the cord from hemorrhage or edema. In the absence of an open wound it is often best to delay a few days until the patient is recovering from spinal shock

Much can be done by modern therapy to rehabilitate the quadriplegic after the acute phase of the injury Expert nursing care is necessary to prevent bedsores and hypostatic pneumonia. Adequate caloric protein vitamin intake is essential to avoid hypoproteinemia and malnutrition. The expert help of a psychiatrist is required as well as the collaboration of the social worker minister and the patient s family to combat the patient's sense of helplessness and depression Once the patient has gained the will to survive and to overcome his handicaps near miracles can be accomplished

The neurosurgeon may have to re enter the picture to correct severe reflex involuntary muscle spasms Surgery may be necessary because of severe radicular pain Quadriplegics who fail to recover any useful control of the hands or musculature that supports the trunk can be helped by orthopedic procedures Though readjustment and rehabilitation require several years at a cost of nearly $10 000 per year this is infinitely preferable to early death or permanent institutional care of the neglected cripple

Treatment of Metastatic Fractures with Internal Fixa

tion. According to Kenneth C Francis[1] (Columbia Univ - Presbyterian Med Center) the most important indication for internal fixation of metastatic fracture is pain Internal fixation is not indicated in the seriously ill terminal patient with widespread osseous and visceral disease and is rarely justified in extensive osseous disease from multiple myeloma with many fractures Other contraindications due to multiple involvement can make the procedure unjustified

Internal fixation of a metastatic fracture necessarily entails surgical exposure of a tumor area. Complications due to exposure of such an area have not been significant Gentle handling of tissues and the avoidance of hematoma are important factors in preventing wound complications As cancerous tissue is highly vascular a considerable amount of bleeding is to be expected if the fracture site is exposed or manipulated Firm pressure and patience may control this problem Incidence of postoperative wound infection has been no higher than with other types of tumor and fracture surgery Fungation of the tumor through the wound after internal fixation has not been a problem

There is no significant danger of producing disseminated cancer after internal fixation of a metastatic fracture Neither is there convincing evidence that the insertion of an intramedullary device carries tumor cells to the distal segments of a bone to produce new lesions in that area When new lesions appear at the proximal or distal extremity of the femur after intramedullary nailing of a fracture of the shaft, their presence most likely antedated surgery of the fracture and bears no relation to its surgical fixation

Postoperative radiation to the fracture site is indicated in radiosensitive lesions It can be started soon after surgery and when accurately and adequately administered may control progression of the local disease for extended periods Not infrequently after stabilization and adequate radiotherapy the fracture may heal

The most commonly encountered primary malignancies of bone such as osteogenic sarcoma and chondrosarcoma when associated with pathologic fracture through the tumor do not lend themselves to treatment with internal fixation because the primary disease must be treated most often by amputation in the absence of demonstrable metastasis

(1) Am. J Surg. 97 484-487 April, 1959

Vascularization of Pseudarthroses of Long Bones According to Clinical and Experimental Study On the basis of radiologic and histologic study of pseudarthroses in two clinical patients and in dogs Robert Judet Jean Judet and Raymond Roy Camille[2] (Paris) concluded that radiologic opacity of the bone ends bordering the lesion is not due to necrosis as has been believed but conversely to an intense osteogenic reaction involving the periosteum and medullary cavity which produces significant bone condensation. This is true not only of pseudarthroses but of all fractures in which the reduction is not strictly anatomic. If reduction is perfect, cure is accomplished per primam without periosteal reaction or intramedullary proliferation In these cases in x rays medullary clarity remains normal the bone does not appear thickened and transparencies of the ends remain unchanged In imperfect reduction the bone must fill in the space between the fragments For this reason all its osteogenic capacity is summoned and osteogenesis involves the periosteum and marrow cavity In most imperfectly reduced fractures apart from any pseudarthrosis x ray films show an obturated medulla, thickening of the bone with opaque ends An extensive opacity should not be considered as a cause of nonunion but rather as proof of a difficult repair necessitating significant osteogenesis

Aside from old floating pseudarthroses organized and stabilized as veritable joints pseudarthrosis is an essentially dynamic state with continuous modifications brought about by etiologic factors and supported by hypervascularization

Pseudarthrosis with its fibroplasia its periosteal reaction its intramedullary osteogenesis represents the permanent struggle of the organism seeking to unite a fracture despite all etiologic factors that oppose its cure What have been described as different types of pseudarthrosis probably are simply different stages of this process In an early stage reparative osteogenesis is not so pronounced and bone ends are still transparent—so called delayed union In a more

(2) Rev chir orthop 44 381 401 Oct Dec., 1958

advanced stage the bone is thickened the medullary canal obturated x ray opacity is definite and more or less pronounced. Two possible eventualities are (1) mechanical factors have been such that there is significant discontinuity between the two ends of the bone consolidation cannot be accomplished and the result is isolated scarring of the two fractured surfaces (organized floating pseudarthrosis) (2) Mechanical factors permit sufficient contact of the fragments that if unfavorable factors (poor immobilization infection poorly tolerated prosthetic material etc.) are eliminated bony union is achieved spontaneously after a sufficiently long time In such instances surgery may hasten consolidation

When it is known that the bone ends are well vascularized pseudarthrosis can be cured by compression without bone support or any operation on the lesion

It might be questioned whether the hypervascularization found in all pseudarthroses studied may not be a factor unfavorable to bony union The causes of pseudarthroses include poor immobilization repeated or poorly conducted operations poorly tolerated synthetic material and infection These are all factors in inflammation with its anatomicopathologic corollary hypervascularization This may be the common link between the various causes and the pseudarthrosis

This study has dealt with only one phase of pseudarthrosis—secondary disturbances after formation of fibrous callus It is probable that pseudarthrosis might also be produced by defective formation of connective tissue scar corresponding to the classic pseudarthroses of general cause"

Pseudarthroses and Defective Callus of Lower End of Femur are evaluated by R Merle D Aubigne and J Lavigne[1] (Paris) on the basis of experience in 40 old injuries on which 47 operations were performed Grafting for pseudarthrosis was performed in 22 instances osteotomy for defective callus in 11 and mobilizing operations for complete rigidity of the knee in 14

Reparative surgery has great possibilities in serious sequelae of fractures of the lower end of the femur In all aseptic cases it is possible at least to provide normal support and

(1) Rev chir orthop 44 403-415 Oct Dec, 1958.

ability to walk Pseudarthroses should be treated by a carefully inserted long graft defective callus by osteotomy In both solid immobilization should be realized at the end of the operation to permit early knee movement. In cases in which mobility of the joint remains insufficient it is possible to reinstate this by a mobilizing operation performed as a second stage The best means for immobilization are the nail plate and Kuntscher s double nail

Results in the 22 patients with pseudarthrosis and in the 11 with defective callus formation show the superiority of the combination graft and osteosynthesis that has always resulted in union and in 60% recovery of useful knee mobility Risk of infectious recurrence unfortunately cannot be prevented absolutely by technic (though its quality is important in reducing this complication) nor by antibiotics Consequences of infection may even require amputation at the least it entails long months of care and definite loss of knee mobility These risks in open fractures should be anticipated especially in cases of infection The risks should not preclude operation in pseudarthrosis however because the infirmity is intolerable In defective callus the decision should be made only after mature reflection and estimation of the degree of impairment operative risks and chances for conservation of knee mobility If the risks with respect to the lesion seem too high and the prospects with regard to the knee too uncertain the deformed leg should be treated by corrective ankylosing resection of the knee which gives with a simple well planned operation without risk, the certainty of recovery of acceptable function in 2 or 3 months

Treatment of Pseudarthrosis of Forearm and Distal Part of Leg by Phemister Method was studied by *J* Boevé[4] (*Rotterdam Holland*) *Pseudarthrosis is a terminal condition of* a fracture that has failed to enter osseous consolidation The terminal condition is due to delayed consolidation This simply means that a fracture fails to heal within the normal period required for such a fracture These types are distinguished common pseudarthrosis defect pseudarthrosis and congenital

Different attempts have been made to explain the cause of common pseudarthrosis e g on the basis of unfavorable circulatory conditions an influence from the nervous system

(4) Arch. chi neerl. 10.273 285 1958.

severe generalized affections systemic affections of the skeleton disturbances in function of the endocrine glands various vitamin deficiencies unfavorable mechanical influences etc. However no satisfactory explanation has been given

In wound healing disturbances in surgically fixed fractures there is definite risk of delayed fracture healing Surgically treated fractures usually tend to heal more slowly than those treated conservatively This is understandable because operative fixation is generally preceded by a number of attempts at manual reposition resulting in tissue damage that is further aggravated by the operation Removal of bone splinters from fresh comminuted fractures constitutes an important cause of delayed fracture healing

Animal experiments suggested that surgical trauma causes the stripped periosteum to start callus formation but not in quantities sufficient to insure healing of the pseudarthrosis Presence of the graft is indispensable in this respect it induces the mesenchymal cells of the fracture ends to become osteoblasts Only a few peripheral cells of the graft remain viable these participate in callus formation As a result of callus formation bone union of the pseudarthrosis occurs because of apposition and metaplasia in the connective tissue

Congenital Pseudarthrosis of Tibia H B Boyd and F P Sage[5] (Memphis Tenn) report 15 cases There are two distinct types of congenital pseudarthrosis of the tibia In the first a cystic defect is present with or without fracture and the pathologic findings resemble those in fibrous dysplasia The diameter of the tibia is not significantly decreased The second type shows sclerosis and tapering of the bone ends probably due to a constricting band of fibrous tissue In this type union is more difficult to secure There is a marked tendency to re formation of the constricting band after its excision and bone grafting

Appraisal of the literature for end results of treatment of congenital pseudarthrosis of the tibia is difficult because relatively few patients have been described after attainment of skeletal maturity and results of the operative procedures advocated should not be evaluated until after completion of bone growth

Since the aim is a socially and economically rehabilitated

(5) J Bone & Joint Surg 40 A 1245-1270 December 1958

patient end result studies should include these two factors

Review of the English literature revealed reports of 91 cases in which age at final follow up could be determined. Of the 91 patients only 16 had reached skeletal maturity Of these, 2 had had persistent nonunion 1 had undergone amputation and 6 had obtained union from an operative procedure the type of which was not definitely stated although the

OPERATIONS FOR TIBIAL PSEUDARTHROSIS REPORTED IN ENGLISH LITERATURE

OPERATIVE PROCEDURE	TIMES REPORTED
Delayed bone grafting	23
Massive tibial onlay grafting	21
Inlay grafting	19
Dual onlay grafting	18
Multiple bone transplantation (Hallock procedure)	13
Bypass grafting	11
Bone flap onlay grafting	8
Two-stage fibular grafting	6
Open reduction and drilling	6
Amputation	4
Fragmentation and medullary nailing	4
Barrel stave grafting and suturing	3
Diamond inlay grafting	3
Composite pedicle grafting	3
Osteoperiosteal grafting and medullary nailing	3
Cast application alone	3
Plate and bone grafting	2
Bone grafting (type unspecified)	2
Onlay grafting from normal opposite fibula	2
Transplantation of one end of fibula	1
Quadruple onlay grafting	1
Resection of periosteum	1
Onlay grafting from fibula, same side	1
Accessory procedures	9
Total	167

author recommended a sliding-end under boneflap-onlay graft." In the other 7 the operative procedure performed was stated. Three had a massive single onlay graft of autogenous or homogenous bone 2 a bypass graft and 2 a delayed graft. Two of the 7 patients had been followed for only 2 years 1 for 5 years and the others for 10 years or more. As well as could be determined the 91 patients had been subjected to 23 varieties of treatment the total number of procedures performed by the reporting authors was 167 (table) This does not include the procedures these 91 patients underwent before being treated by the reporting authors

Boyd and Sage advise early surgical treatment to prevent establishment of marked shortening and deformity. In the first type of congenital pseudarthrosis the cyst should be curetted and the defect filled with bone chips. Further bone grafting may or may not be necessary. In the second type wide resection of the constricting band of pathologic soft tissue should be done combined with suitable bone grafting and adequate internal and external fixation. The latter achieved by casts followed by suitable braces should be continued until skeletal maturity or until a tibia of relatively normal size develops. Repeated clinical and x ray examinations should be performed until skeletal maturity is reached. If at any time evidence of narrowing of the bone or sclerosis of the medullary cavity appears prophylactic operative intervention with wide resection of the constricting band of scar tissue should be done. Reinforcing grafts should also be placed about the area of previous pseudarthrosis. In cases of extreme deformity amputation may be indicated but only if a prosthesis may be expected to provide a better weight bearing extremity than the best extremity that could be obtained from successful reconstructive surgery.

Seven of the authors 15 patients have reached skeletal maturity. All 7 had repeated reconstructive operations. Surgical results in 1 patient were unsatisfactory and amputation was necessary. Three cases were moderately successful (2 of the patients needed braces and 1 needed a shoe elevation) and 3 were successful in outcome.

THE SPINE AND PELVIS

Congenital Anomalies of Vertebrae are evaluated by S N Basu[6] (Inst. of Child Health Calcutta). There are four stages of development before the vertebral column takes its mature or final form (1) preliminary stage consisting of the non segmented notochord (2) stage of mesenchymal or blastemal vertebral column derived from the sclerotomes (3) stage of chondrification which leads to the cartilaginous vertebral column and (4) stage of ossification. Congenital anomalies of the vertebrae result from some errors in any of these stages. There can be supernumerary vertebrae or less

(6) Indian J Pediat. 26:3-3-328 Ma 1958

vertebrae due to nonsegmentation or undersegmentation. Failure of development or hypoplasia of the two chondrification centers of the body is thought to be responsible for hemivertebrae. A "butterfly" or cleft vertebra is due to the persistence of the remnants of the notochord There are four types of butterfly vertebrae (1) complete separation of the two halves by a wide cleft (2) bridging of the two halves by strands of bone (3) connection of the two halves by a relatively dense bony bridge and (4) a narrow sagittal cleft between the two halves *giving rise to halves of equal size or of* slightly unequal size with lateral displacement or anterior wedging

Anomalies of the arch may affect several sites One or more defects may be present in a single arch Spina bifida is a congenital defect of the arches that permits extrusion of the meninges or spinal cord

Basu reports a case on a boy aged 7 in whom x rays of the lumbar and lower dorsal regions showed multiple hemivertebrae The deformed vertebrae occupied practically the entire region There were also some errors in segmentations of the ribs especially on the right side. The upper three thoracic vertebral bodies showed a narrow sagittal cleft in each and the corresponding ribs were normal Hemivertebrae were also noted in the cervical spine. Four carpal centers were observed in the x ray films of the wrist joints. Except for the spine all other bones were normal

The possibility of asymmetrically placed remnants of the notochord to explain the simultaneous occurrence of multiple hemivertebrae and sagittal cleft or butterfly vertebrae should be kept in mind.

Sciatica and Intervertebral Disk Experimental Study is reported by M J Smyth and V Wright[7] (Univ of Leeds) After removal of the disk material from 8 patients with classic sciatica and unequivocal disk herniation pressing on the 5th lumbar and 1st sacral nerve roots a loop of nylon thread was passed around the involved root and its two ends brought to the surface It was so placed that when the slack was taken up the loop pressed on the root at the same place the disk had In 5 other patients a loop of nylon thread was passed through the dura mater and brought to the surface alongside a loop around the involved root In 6 patients a

(7) J Bon & Joint Surg 40 A 1401 1418, December 1958.

nylon loop was passed around two roots and in 11 patients a loop was passed through the ligamentum flavum the interspinous ligament or the annulus fibrosus

Postoperatively when the patients had complete relief from sciatic pain it was found that a gentle pull on the thread around the involved root resulted in severe pain simulating

TABLE 1—COMPARISON OF RESULTS OF NERVE ROOT AND DURAL STIMULATION IN 5 PATIENTS

RESULT OF STIMULATION OF DURA MATER	RESULT OF STIMULATION OF NERVE ROOT
Slight ache virtually insensitive	Sciatic pain
Slight pain which disappeared	Sciatic pain
No pain insensitive	Severe pain
Ache in lower lumbar region	Sciatic pain
Insensitive	Sciatic pain

TABLE 2.—RESULTS OF STIMULATION OF INTERSPINOUS LIGAMENTS LIGAMENTUM FLAVUM AND ANNULUS FIBROSIS IN 11 PATIENTS

INTERSPINOUS LIGAMENT	LIGAMENTUM FLAVUM	ANNULUS FIBROSIS
Insensitive	Dragging sensation	
Insensitive	Slight ache in back	
Insensitive	Insensitive	
Insensitive	Slight dragging sensation	
Insensitive	Insensitive	
Slight dragging sensation	Vague ache	
Insensitive	Insensitive	
Insensitive	Insensitive	
Insensitive	Insensitive	
Insensitive	Insensitive	
Insensitive	Insensitive	Backache in lower lumbar region

the preoperative sciatica. Pain was produced by only slight pressure of the thread on the nerve In no sense was the traction great enough to stretch the root. The nerve roots which had not been pressed on by the disk were less sensitive but pain could be produced by slight pressure on these roots also The patients were virtually unaware of stimulation and movement of the dura mater (Table 1) The ligamentum flavum and interspinous ligaments were insensitive and traction on the annulus fibrosus produced lumbar backache but no sciatic pain (Table 2)

The longitudinal extent of pain resulting from pressure on a nerve root appeared to be proportional to the amount of pressure exerted. Pain did not extend further on maintaining the same pressure for a longer period The pain pathway

TABLE 3—Reflex and Motor Changes Found Postoperatively and after Pressure on Nerve Root and Dura Mater

Case	Untouched Motor Power	Untouched Knee Reflex	Untouched Ankle Reflex	Stimulation of Dura Mater Motor Power	Stimulation of Dura Mater Knee Reflex	Stimulation of Dura Mater Ankle Reflex	Sacral or Lumbar Nerve Root	Pressure on Nerve Root Motor Power	Pressure on Nerve Root Knee Reflex	Pressure on Nerve Root Ankle Reflex	Comment
9 Test 1	Full	+	Absent	Full	+	Absent	S 1	Full	+	Absent	No change
Test 2 (6 days later)	Full	+	Absent				S 1	Full	+	Absent	No change
10	Weakness extensor hallucis longus	+	Absent	Weakness extensor hallucis longus	+	Absent	L 5	Definite weakness extensor hallucis longus	+	Absent	Stimulation of fifth lumbar [illegible] root accentuated weakness of extensor hallucis longus
12	Full	+	Absent	Full	+	Absent	S 1	Full	+	Absent	No change
11	Weakness [illegible] flexors of toes	+	Absent	W[illegible] flexors of toes	+	Absent	L 5	Weakness [illegible] flexors of toes	+	Absent	No change
31	Full	+	Absent				S 1	Full	+	Absent	No change
33	Slight [illegible] extensor hallucis longus	+	+				S 1	Slight [illegible] extensor hallucis longus	+	+	No change
30	Full	+	Absent				S 1	Full	+	Absent	No change

of each nerve root was relatively narrow and distinct from its fellow.

There were no knee reflex changes produced by pressure on nerve roots (Table 3). In most patients the ankle reflex was already absent. Weakness of the extensor hallucis longus was found in 3 patients and in 1 this was aggravated by pressure on the nerve root. In 5 patients loss of pain sensation occurred with pressure on nerve roots. In no patient were reflex, motor or sensory changes produced by pressure on the dura mater (Table 3). The findings support the opinion that it is pressure on the nerve root by the herniated disk that is responsible for the clinical picture of sciatica.

In conservative treatment of sciatica immobilization can only relieve pain caused by movement of the nerve root on the disk. If therefore after a week or so with good immobilization pain persists it means the disk is still touching the root. It would seem reasonable not to continue conservative treatment too long as the nerve root may become highly sensitive and continue to cause pain even after removal of a disk. Postoperative reactionary fibrosis with a sensitized root may be sufficient to maintain an acute sciatica.

► [Although the series of patients used in this experiment was small it is of particular interest to note that the ligamentum flavum and interspinous ligaments were insensitive and that traction on the annulus fibrosus produced lumbar backache but no sciatic pain, whereas traction on the nerve root reproduced the symptoms of sciatica. I am in complete accord with the authors that if after a period of immobilization the pain in the sciatic distribution persists, other means may be necessary to relieve distress. This investigation of the authors would seem to verify the more recent conclusions that the ligamentum flavum is not to blame for the pain as it had been thought to do in early investigation of the protruded intervertebral disk.—Ed.]

Another Look at the Problem of Lumbosacral Pain and Sciatica. According to Thomas King[8] (St. Vincent's Hosp., Melbourne), early and incipient disk degeneration may be present long before there are the usual and easily recognized radiologic signs of gross disk degeneration. In view of the frequency of lamellar injuries noted in spinal autopsies they might perhaps be the commonest cause of lumbosacral pain in the 3d to 4th decades in those patients in whom the cause lies in the vertebral column. Doubtless there are other but unproved causes of lumbosacral pain that arise from injuries to the muscles, ligaments, etc., but they do not at present ap

(8) M. J. Australia 1:8-12, Jan. 3, 1959.

metastasis to the right cerebellum. The chiropractic manipulations apparently squeezed the cerebellar tonsils into the great foramen. ► [This author merely points out what I and other authors have pointed out in previous publications that many conditions may simulate that of the protruded intervertebral disk. All patients presenting themselves with low back and sciatic pain" need a complete general physical examination, x rays of the lumbar spine and pelvis as a bare minimum, plus a neurologic and orthopedic examination if the exact diagnosis is to be made. Certainly not all patients with low back and sciatic pain have protruded intervertebral disks and it behooves the medical profession to make an accurate diagnosis before instituting treatment.—Ed.]

Discography in Low Back Pain and Sciatica Analysis of 73 Operated Cases is presented by Sverker Nordlander Ernst F Salén and Lars Unander Scharin[1] In discography



Fig 124 (left).—Normal discogram.
Fig. 125 (right).—Epidural leakage. Disk space communicates through posterior rupture with epidural space. Note leakage in form of opacified streaks (*arrow*).
(Courtesy of Nordlander S *et al.* Acta orthop. scandinav 28:90-102 1958.)

contrast medium is injected into the disk spaces Diagnosis is based on x ray findings and on the nature of the pain felt by the patient during distention of the disk space Two types of normal discograms are seen One shows a large relatively well delimited space lying somewhat dorsally in the disk (Fig 124) The other shows two opaque layers lying one above the other and communicating through a narrow central channel In severe disk degeneration the disk space is greatly enlarged and its outline is irregular A more or less sharply delimited streak of contrast medium runs posteriorly or posterolaterally to the periphery of the disk in dorsolateral rupture without leakage In ruptured disk with demarcated retrodiscal leakage a sharply delimited rupture runs posteriorly and penetrates the surface of the disk appearing as a local accumulation of contrast medium either below the posterior longitudinal ligament (bulging disk) or on its

(1) Acta orthop scandina 28:90-102, 1958.

dural aspect (perforated disk rupture) Epidural leakage (Fig 125) results in streaks of contrast medium around the dural sac Opaque streaks extend laterally and downward into the intervertebral foramens when perineural leakage is present.

Most of the 73 patients who underwent operation for low back pain or sciatica were examined by myelography and discography of the 3 lowest lumbar disks Evaluation of the reliability of discography and myelography based on findings at operation did not indicate that discography is superior to myelography for routine diagnosis of herniation of an intervertebral disk. More than 50% of patients in whom no disk herniation was found at operation had typical pain on injection of contrast medium during discography Discography is indicated in severe cases of low back pain and sciatica where conservative treatment has failed and myelographic findings are inconclusive Discography should also be used to complement myelography when recurrence of disk herniation is suspected and myelographic findings are inconclusive

► [I am surprised to see this article reporting discography as an aid in the diagnosis of a protruded intervertebral disk. This method was first used in Sweden as an investigative procedure and it was my understanding that it had ultimately been abandoned as a means of diagnosis. We tried in a number of cases to make a diagnosis by discography where we could not make it clinically or by myelographic studies and found that it added nothing to our knowledge and only added the possibility of damage to the annulus by the introduction of the needle for the carrying out of the discogram. Personally I would not want it done on myself should I have low back and sciatic pain.—Ed.]

Spinal Cord Compression Caused by Protruded Thoracic Disk Report of Case Treated with Anterolateral Fenestration of Disk is presented by C Crafoord T Hiertonn K. Lindblom and S E Olsson[2] (Stockholm)

Woman, 36 who had low back pain radiating down one thigh for several months rather suddenly manifested spastic paresis of both legs. There was difficulty in starting urination and numbness up to the umbilical region. Both limbs showed moderate loss of power with weakness of dorsiflexion and pronation of the right foot being especially pronounced. Knee and ankle reflexes were exaggerated and patellar clonus was elicited on the right. Plantar reflexes were bilaterally extensor X rays revealed calcification of the disk between the 10th and 11th thoracic vertebrae, with part of the calcification protruding into the spinal canal. Myelography with oxygen demonstrated anterior compression of the cord at this level

( ) Acta orthop. scandinav 28 103-107 1958.

Fenestration of the disk between the 10th and 11th thoracic vertebrae was performed by transthoracic anterolateral approach 3 months after onset of paralysis. An incision was made in the annulus fibrosus and the opening was widened by excision of the bony margins to allow insertion of a curet. A creamy white mass exuded through the incision and more of the material was removed from the center of the disk. To avoid cord damage the posterior part of the disk and the prolapse were not cureted.

The patient's ability to start micturition returned on the 2d postoperative day. Sensory and motor function of the legs improved and within 3 weeks the paresis was gone. X-ray examination 2 months after operation showed less calcification within the disk and in the protrusion.

Disk fenestration permits removal of all loose tissue within a disk so that no increase in the size of a disk protrusion occurs when pressure is applied to the disk. Fenestration has proved effective in the treatment of disk protrusions in dogs. In man retroperitoneal lumbar disk fenestration was used by Hult in 1951. Results were difficult to evaluate and for a time the method was given up. Because of the excellent results in dogs the method was used later in patients with nerve root compression caused by ruptured cervical disks. In this region the approach was simple and results were more promising.

The authors were unable to find other reports in the literature concerning use of disk fenestration in man when a protrusion had caused spinal cord compression.

On Surgically Treated Herniated Intervertebral Disks. Bertil Knutsson and Gunnar Wiberg[3] (Univ. of Lund) analyzed data on 251 patients who had been operated on for herniated intervertebral disk. Prolapsed disk was found at operation in 199, protruded disk in 20 and normal disk in 32. All but 3 of the prolapsed disks were in the lumbosacral space or the space between the 4th and 5th lumbar vertebrae.

Weakness in dorsal flexion of the great toe was noted in almost 71% of the patients in whom operation revealed prolapse or protrusion of the disk between the 4th and 5th lumbar vertebrae. Of those with paresis of the great toe 63% had prolapse or protrusion of the disk between the 4th and 5th lumbar vertebrae.

The Achilles tendon reflex was impaired or absent in 83% of the patients in whom operation revealed prolapse or pro-

(3) Acta orthop. scandinav. 28:108-123, 1958.

trusion of the lumbosacral disk. Of those with impairment or absence of the Achilles tendon reflex 81% had prolapse or protrusion of the lumbosacral disk.

Myelography was performed with air-oxygen in 80 patients Operation confirmed the finding in 77% of the 34 patients in whom myelography suggested prolapse of the disk between the 4th and 5th lumbar vertebrae and in 9 of 10 in whom myelography suggested prolapse of the lumbosacral disk Myelography was negative in 32 patients Operation revealed herniation in 4 of 11 patients in whom myelography failed to reveal a pathologic disk between the 4th and 5th lumbar vertebrae and in 9 of 13 who had negative lumbosacral disk findings on myelography

Myelography with water soluble contrast medium gave more reliable results than did myelography with air-oxygen Operation confirmed positive myelographic findings in 91% of 32 patients with myelographic findings suggestive of protrusion of the lumbosacral disk and in 93% of 28 with myelographic findings suggestive of protrusion of the disk between the 4th and 5th lumbar vertebrae. Of 12 patients operated on whose myelograms had been negative 9 had protrusion of the lumbosacral disk and 1 had protrusion of the disk between the 4th and 5th lumbar vertebrae

Of 241 patients who answered a questionnaire 4 12 years after operation for herniated intervertebral disk 94 5% reported improvement. Average convalescence had been 4.2 months for females and 4.3 months for males

Reoperation was performed in 25 patients in 7 fusion was performed because of persistent back pain and in 18 reoperation was performed because of sciatic pain Of the 18 patients 5 had true recurrence with a new prolapse of the same disk 4 had prolapse of another disk on the same side 5 had prolapse of the same disk or another disk on the other side 2 showed disk protrusion 1 had scar tissue around the nerve root and 2 showed no abnormality at operation One patient was reoperated twice for sciatic pain.

Contrast Examination of Lumbar Interspinous Ligaments Preliminary Report is presented by Rolf Köhler[4] (Univ of Helsinki)

Technic.—The patient is placed in lateral position on the Bucky

(4) Acta radiol. 5 :21 27 July 1959

table with the lumbar spine flexed. The three lowermost interspinous spaces are palpated and marked and the skin is cleansed. Using a 20-ml. syringe fitted with a no. 12 needle, a small quantity of local anesthetic is injected subcutaneously in the midline over the 5th lumbar to 1st sacral interspinous space. The needle is introduced to its entire length at right angles to the skin but 0.5-1 cm. lateral to the midline in the sagittal plane along the interspinous ligament. After injection of 5-7 ml. of the anesthetic, the procedure is repeated on the opposite side. The two nearest ligaments above are similarly treated.

The series of injections is repeated 10-15 minutes later with a contrast medium substituted for the anesthetic, 4-5 ml. of the medium being introduced as close to the ligamentous wall as possible. A 20% monoiodized water soluble preparation was used in most examinations to prevent injury in the event of accidental introduction into

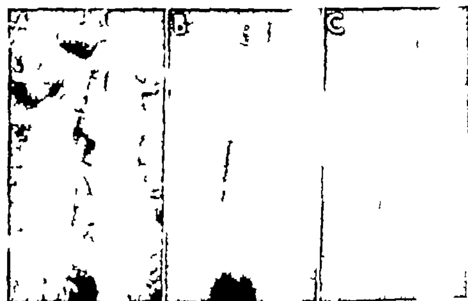


Fig. 126.—*A*, broad communication in 5th lumbar to 1st sacral interspinous space. Contrast medium irregularly distributed and varies in density, as generally occurs in degenerated fat-filtrated ligaments. *B*, tomogram 3 cm. *C*, tomogram 4 cm. (Courtesy of Köhler, R.: Acta radiol. 52:21, 27 July 1959.)

the lumbar canal. The density obtained is satisfactory but since accidents are unlikely, a slightly more concentrated preparation such as Urografin 30% is preferred. After injection of the contrast medium, an x-ray is obtained in the anteroposterior projection with the patient supine and with the lordosis reduced as much as possible. In positive cases, tomography is performed with the patient in the same position.

In normal spines a well defined contrast-free zone, usually slightly spindle shaped and 3-10 mm. wide, is observed between the spinous processes. In pathologic cases the contours of the contrast medium are often slightly irregular or

ill defined Blotched or streaked penetration of medium into the ligamentous area probably corresponds to degenerative changes in the ligament (Fig 126) Unilateral rounded bulging of contrast medium toward or slightly past the midline occurs when there is a defect within only one half of the ligament In total rupture of the ligament, a homogeneous accumulation of contrast medium occupies a greater or lesser part of the interspinous space a connection being present between the deposits on the right and left sides

Of 100 patients examined after injection of contrast medium 55 were operated on in most of whom diagnosis was a prolapsed disk X ray findings corresponded well with operative findings Of the 55 surgically treated patients 19 had normal ligaments in the level of the 3d to 5th lumbar interspinous spaces In 15 of these prolapse of a disk was found 36 showed pathologic ligaments at one or several interspinous spaces A pathologic ligament and prolapse at the same level were present in 20 patients and at different levels in 7

► [This is an interesting experimental paper I had an opportunity to talk about it with Professor Kallio and observed a number of his roentgenograms. Whether the test will prove of clinical value depends on more examinations Professor Kallio uses it in preparation for the reconstruction of the intraspinous ligaments by dermografts and his results to date have been quite gratifying but need further verification.—Ed.]

Lumbosacral Fusion Results of Simple Postoperative Regimen in 95 Cases are presented by Harry D Morris and Truman Kerr[8] Of 95 patients who had lumbosacral fusion performed during 14 years by members of the orthopedic department of the Ochsner Clinic with average postoperative follow up of 7 years successful fusion was obtained in 85% Only operations performed for noninfectious lesions were included in this study The criterion for determining the results of fusion was demonstration of arthrodesis in biplane bending films

Postoperative treatment consisted of complete rest on a firm bed for 3 weeks followed by ambulation Male patients wore a Knight lumbosacral brace and female patients a reinforced lumbosacral corset (Figs 127 and 128) The support was worn for an average of 7 months and was discarded on demonstration of solid arthrodesis with biplane bending

(8) South M J 54 546 May 1959

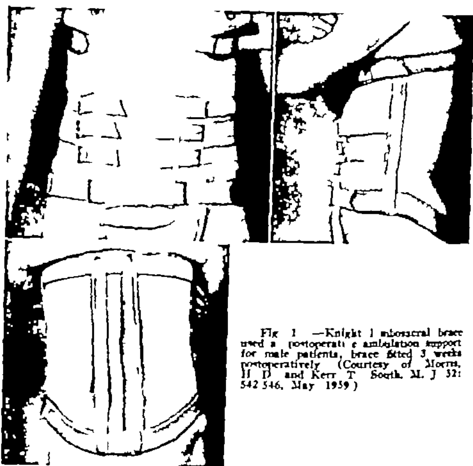


Fig 1 —Knight lumbosacral brace used as postoperative ambulation support for male patients, brace fitted 3 weeks postoperatively (Courtesy of Morris, H D and Kerr T South. M. J 52: 542 546, May 1959)

films Some patients with pseudarthrosis were able to discard the supports because symptoms were relieved despite lack of x ray demonstration of satisfactory fusion

It is well known that the longer the area of fusion the greater the incidence of pseudarthrosis This however was not taken into consideration in evaluating the results The fusion area in the original 107 patients included the 2d lumbar vertebra to the sacrum 1 3d lumbar vertebra to the sacrum 15 4th lumbar vertebra to the sacrum 88 and 5th lumbar vertebra to the sacrum 3 Thus the fusion area in most of the patients was from the 4th lumbar level to the sacrum

Of 95 patients with adequate follow up solid arthrodesis as demonstrated in biplane bending films was obtained in 81 (85%) and in 14 (15%) pseudarthrosis resulted Of the 47 patients operated on for spondylolisthesis pseudarthrosis



Fig 128.—Reinforced corset fitted 3 weeks postoperatively for female patients solid back, side-lace garment used routinely (Courtesy of Morris, H D and Kerr T: South. M. J 52 542-546 May 1959)

occurred in about 17% an incidence slightly higher than that reported by Bosworth and co-authors but considerably below that reported by Hammond and associates

Spondylolysis Its Anatomy and Mechanism of Development. Hilel Nathan[6] (Hebrew Univ Hadassah Med. School) examined 450 skeletons and found 19 with spondylolysis In 16 skeletons the spondylolysis was typical in 2 atypical and 1 showed typical and atypical spondylolysis in different vertebrae In typical spondylolysis generally found in the lower lumbar vertebrae the neural arch of the vertebra was separated on each side from the rest of the vertebra by a cleft through the isthmus or pars interarticularis The cleft of the isthmus was always located between the downward projecting inferior articular processes of the vertebra above and the upward projecting superior articular processes of the vertebra below Such clefts appear to be produced by compression of the isthmuses by these articular processes in a pincers grasp (Fig 129)

Skeletons were found in which the development of spondylolysis had stopped before total separation of the vertebral

(6) J Bone & Joint Surg 41 A 303-320 March, 1959

arch had occurred There were pronounced depressions on the upper and lower surfaces of the isthmuses precisely at their sites of contact with the articular processes of the adjoining vertebrae The term prespondylolysis has been applied to these cases The depressions in the neural arch were in all likelihood the result of traumatic mechanical erosion

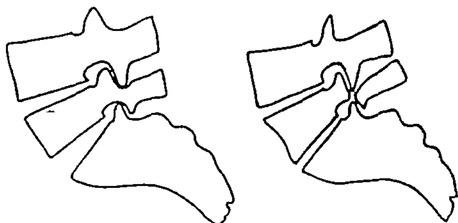


Fig 129 (left) —Type of vertebral column that is anatomically predisposed to development of spondylolysis. I thm of 5th lumbar vertebra rest below on upward projecting articular process of sacrum Inferior articular process of 4th lumbar vertebra exerts pressure from above These two articular processes thus compress isthmus in pincers grasp. Vertebral bodies spinous processes and other vertebral processes do not hinder this compressing mechanism.

Fig 130 (right) —Same type of spine with typical spondylolysis showing cleft of spondylolysis. Articular processes of 4th lumbar and sacrum are directly related to cleft and penetrate it somewhat.

(Courtesy of Nathan, H : J Bone & Joint Surg 41 A 303 320 March, 1959)

It may be that in some instances the final breakthrough of the thinned weakened isthmus occurred suddenly as the result of trauma e g a jump or fall

A preceding bone abnormality or defect of the isthmus would be unnecessary for the development of spondylolysis However if there is a local weakness of the isthmus the traumatic action of the articular processes against the isthmus would be facilitated

The differences observed by Nathan between spondylolytic and nonspondylolytic vertebral columns—in size, proportions and form of the vertebral bodies their spines transverse and articular processes and the relationship between them—explain why some persons are susceptible to the development of spondylolysis In the spondylolytic cases those proportions and relationships were such that the articular processes above and below the affected vertebra were free to reach and compress the isthmus (Figs 129 and 130) In nor

mal spines these articular processes are not free to reach the isthmus therefore development of spondylolysis is not possible.

In skeletons anatomically conditioned or predisposed to spondylolysis various circumstances may promote onset or hasten progress of the process Anything tending to flatten the lumbar intervertebral disks exaggerate the lumbar lordosis and approximate the vertebrae will favor the impingement of the articular processes against the isthmus and so promote the development of spondylolysis Among these adjuvant factors may be included trauma erect posture lifting and carrying of heavy weights and advancing age including the thinning of intervertebral disks observed in older subjects

In atypical spondylolysis no direct relationship of the clefts to the articular processes of the vertebrae above and below was observed In these cases the cause could not be established The clefts in skeletons with these lesions were simple fractures that had failed to heal for some undetermined reason

Spondylolisthesis Study of 53 Cases Treated by Spine Fusion and 32 Cases Treated by Laminectomy is presented by L E Laurent[7] (Helsinki) Among 809 patients with spon-

TABLE 1—CLINICAL PICTURE IN PATIENTS UNDER AGE 20

Age	5—15	16—19	Total
No pain	2	1	3
Low back pain	9	19	28
Radiating pain	2	5	7
Positive Lasègue's sign	6	5	11
Loss of the ankle jerk	5	4	9
	24	34	58

TABLE 2—AGE AND SEX OF OPERATIVELY TREATED PATIENTS

	10—19	20—29	30—39	40—49	50—59	Total
Men	7	11	13	12	5	48
Women	5	2	12	12	6	37
	12	13	25	24	11	85

dylolisthesis or spondylolysis the lesion was located in the 5th lumbar vertebra in 71 1% in the 4th in 25 1% and in higher lumbar vertebrae in 3.8% Spondylolysis without olisthesis occurred in 6 3% In 6 4% the onset of symptoms was related to trauma Ten patients had no subjective symp-

(7) Acta orthop scandinav., supp 35 1958

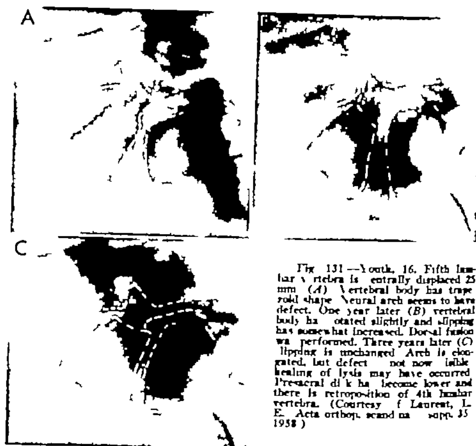


Fig 131 —Youth, 16. Fifth lumbar vertebra is ventrally displaced 25 mm (*A*) Vertebral body has trapezoid shape Neural arch seems to have defect. One year later (*B*) vertebral body has rotated slightly and slipping has somewhat increased. Dorsal fusion was performed. Three years later (*C*) slipping is unchanged Arch is elongated, but defect is not now visible healing of lysis may have occurred Presacral disk has become lower and there is retroposition of 4th lumbar vertebra. (Courtesy of Laurent, L. E. Acta orthop. scand. supp. 35 1958)

toms 569 (70 3%) had low back pain only and 230 (28 3%) had sciatica with or without neurologic signs

Of 58 patients under age 20 91% had involvement of the 5th lumbar vertebra (Fig 131) Symptoms of root irritation occurred in 27 (Table 1) Eight of 12 patients with total or subtotal olisthesis of the 5th lumbar vertebra were under age 20 A great progression of olisthesis was observed in 7 adolescents aged 13-18. In 4 of these increase in slipping occurred despite dorsal spine fusion Laurent believes that the different degrees of slipping of the olisthetic vertebral body in adolescence may depend on variations in the stability of the disks at this age Once the disks attain final form at age 20 and ossification of the vertebrae is complete no progression occurs as a rule

Of 85 patients (Table 2) treated surgically 59 (69%) had sciatica A combination of symptoms which could be explained as root syndrome occurred in 12 In 45 explorations or laminectomies disk protrusion was found twice and ad

hesions to nerve roots 6 times Direct compression of roots due to the fibrocartilaginous tissue in the pars interarticularis was not observed Although root irritation due to fibrocartilaginous tissue may occur in this condition it is usually due to instability of the spondylolytic vertebra The low back pain probably emanates from muscles ligaments and intervertebral joints

Of 77 surgical patients who had follow up examination 44 had dorsal fusion with or without exploration 7 had ventral



Fig 132 —Girl, 16 *A* subtotal olisthesis of 5th lumbar vertebra. Ventral transperitoneal fusion with iliac graft was performed. *B* 18 months later lumbosacral fusion is sound Slipping is unchanged. (Courtesy of Laurent, L. E.: Acta orthop scandinav supp. 35 1958.)

transperitoneal fusion (Fig 132) and 26 had laminectomy without fusion Follow up was 3 10 years for the fusion cases and 1 2 years for the laminectomy cases Primary consolidation of the graft was achieved in only 19 cases (37%) uncertain union or nonunion occurred in 32 (63%) Functional results were satisfactory in many cases however despite uncertain union or nonunion Results of treatment with fusion were clearly better than results of laminectomy without fusion Satisfactory results with fusion were obtained in 44 of 51 cases and with laminectomy in 17 of 26 cases

Traumatic Pseudospondylolisthesis Spondylolysis the etiology of which is not certainly known is the basic reason for dislocation of the vertebra in most cases of spondylolisthesis In some patients however trauma is a significant factor Trauma may play a secondary role causing dislocation of a vertebra already affected by spondylolysis In other patient the role of trauma is primary It may cause fracture in

the pars interarticularis region of the neural arch of the vertebra and so allow spondylolisthesis to start Fractures may also originate in the articular processes of the small intervertebral joints where extensive ligament lacerations occur at the same time resulting in pseudospondylolisthesis with

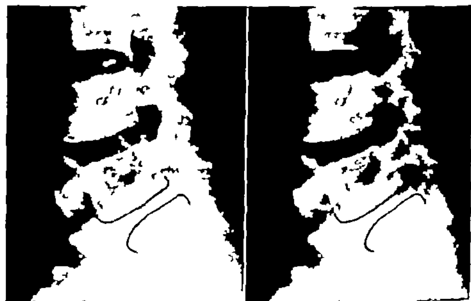


Fig 133 (left) —Lateral view of lumbar spine immediately afte trauma. No sign of spondylolisthesis are present.

Fig. 134 (right) —Lumbar spine 3 months after trauma 1 5 cm. spondylolisthesis in 5th lumbar vertebra.

(Courtesy of Kettunen K. O and Köhler R.: Ann. chir et gynaec. Fenniae 48 171 176, 1959)

out spondylolysis K. O Kettunen and R. Kohler[8] (Univ of Helsinki) report such a case.

Man 35 was hit in the area of the lumbar spine by a rolling log The blow bent his trunk sharply forward and twisted it to the right. X rays revealed fractures in the transverse processes of the 1st 5th lumbar vertebrae and fractures of the spinous processes of the 4th and 5th lumbar vertebrae. There was no evidence of spondylolisthesis (Fig 133) Bed rest for 1 month was prescribed. X rays 40 days after injury revealed spondylolisthesis of the 5th lumbar vertebra. This had increased to 1 5 cm. 3 months after trauma (Fig 134) Tomography revealed that the left inferior articular process of the 5th lumbar vertebra was displaced to the ventral side of the superior articular process of the 1st sacral vertebra and was also displaced caudally There was an olisthesis of 5 mm on the right aspect of the 5th lumbar vertebra, but the intervertebral space was normal in height. On the left aspect of the vertebra, the olisthesis was 15 mm., and the intervertebral space was narrowed

(8) Ann. chir et gynaec. Fenniae 48 171 176, 1959

Current Concepts in Osteoporosis are evaluated by Charles H Epps Jr.[9] (District of Columbia Gen'l Hosp Washington D C.) Osteoporosis is a metabolic bone disease occurring in both sexes and at all ages The condition is associated with many systemic diseases and also occurs as a single pathologic entity Osteoporosis is a deficiency of bone substance and may develop from absorption of bone matrix with poor replacement from inadequate production of bone matrix or from destruction of matrix. Estrogens androgens adequate protein intake vitamin C and stress are the factors known to be vital to formation of bone matrix. Hence any condition producing one or any combination of these factors will cause osteoporosis

Osteoporosis may be diagnosed by radiologic chemical and histologic criteria. The patient may present with clinical signs and symptoms of a specific disease (acromegaly Cushing's syndrome thyrotoxicosis scurvy etc) and the osteoporosis may be present as an additional manifestation The patient however may have initial bone pain chiefly in the back, or pathologic fractures (more common in the spine and femoral neck) as the presenting symptom This is usually the case in postmenopausal and senile patients In addition there may be bone tenderness on physical examination The radiologic criterion is radiolucency of the skeleton The chemical diagnosis is established by exclusion of other metabolic bone diseases and neoplastic disease. In osteoporosis per se the serum calcium phosphorus and alkaline phosphatase values are within normal limits The fundamental feature in the histologic picture of osteoporosis is that the total mass of bone is less than normal

Regardless of the primary cause however several broad principles of treatment should be followed The diet should be adequate in proteins calcium phosphorus and vitamins C and D Androgens and estrogens should be given together to stimulate production of bone matrix Prolonged immobilization of patients in bed or of extremities in casts should be avoided so that the osteoblasts can receive the necessary stimuli from function Analgesics may be necessary to encourage early motion especially after a fracture Physical therapy measures (therapeutic exercises) and orthopedic de-

(9) J Nat. M A. 51 106-11., March, 1959

vices (corsets braces) should be used when these will encourage motion and enhance restoration or preservation of function

THE HIP LEG KNEE ANKLE AND FOOT

► ↓ Consider carefully the following 4 articles At present, no one procedure for rehabilitation of the patient with a disabled hip is applicable in every case. Drs Aufranc and Sweet, using the Smith-Petersen cup arthroplasty showed that about 85% of the patients so treated were satisfied with the end result this has been our experience also. The more recent dermal arthroplasty as carried out by Professor Kallio and described in the article by Kelley and Gross would likewise seem to indicate a satisfactory result from this type of arthroplasty As yet, we have not had any experience with this procedure but have had considerable experience with the insertion of a prosthesis and vitallium cups. All methods of treatment have to be selected for the individual patient and certainly in a young person one would choose an arthroplasty of one type or another in preference to the insertion of the foreign-body hip prosthesis if at all possible. The insertion of a prosthesis leaves little else to do in the event of a failure of the operation, but after insertion of a vitallium cup or doing of a dermal arthroplasty one could still arthrodese the hip if necessary In a young person or an older person with a satisfactory femoral neck and not too much degeneration of the femoral head, a cup arthroplasty or dermal arthroplasty would be preferred to an arthrodesis or insertion of a hip prosthesis. In Great Britain the arthroplasty procedure has not been popular Batchelor in his presidential address to the Royal College of Surgeons, stated that in his experience the arthroplasty had been more or less unsuccessful and felt that there had been a tendency to return to the older and better-established procedures of arthrodesis displacement osteotomy and pseudoarthrosis. It is for this reason that he emphasized, in his presidential address, the various methods of securing an arthrodesis of the hip. It is granted that all methods fail occasionally and it is still up to the surgeon to choose the method of treatment according to the individual patient rather than to generalize on the best method of treatment to be universally used —Ed.

Study of Patients with Hip Arthroplasty at Massachusetts General Hospital Otto E Aufranc and Elliott B Sweet[1] investigated late results of vitallium mold arthroplasties in 171 patients who were re-examined 5 or more years after operation The original diagnoses in 201 arthroplastic hips were degenerative arthritis (81) congenital dislocation and subluxation (51) old fractures of the femoral neck (23) septic arthritis and ankylosis (18) septic arthritis (14) traumatic dislocation and/or fractured acetabulum (9) old tuberculous arthritis (4) and chondroma of the acetabulum (1)

Results were classed according to diagnosis on the basis of clinical results and patient evaluation of the results (Fig

(1) J.A.M.A 170 507 515 May 30 1959

135) Clinical results were considered excellent in 4.5% good in 17% satisfactory in 60% and unsatisfactory in 18.5% All excellent and most good results were in patients with unilateral arthroplasty for unilateral disease Most patients were eliminated from excellent and good classifications by limitations of walking endurance and inability to tie their shoes and climb stairs foot after foot The patient reaction was more favorable than the clinical evaluation A large percent

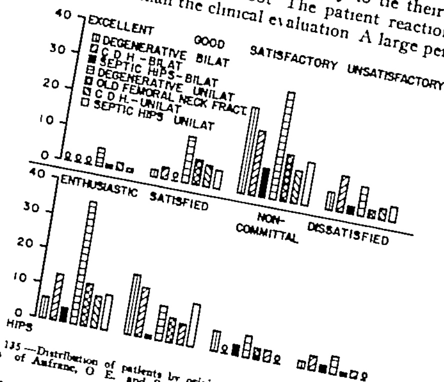


Fig 135 —Distribution of patients by original diagnosis and two-way evaluation. (Courtesy of Aufranc, O E. and Sweet, E. B : J.A.M.A. 170:507 515 May 30 1959)

age of patients with unsatisfactory clinical results were pleased with the result usually because of relief from pain Among the total of 201 arthroplastic hips in 51% the patient was enthusiastic, in 35% satisfied in 6% noncommittal and in 8% dissatisfied

Complete relief from pain was achieved in 27% of hips treated Only 16% of patients had disabling pain Walking endurance was unlimited in 24% and was markedly limited in only 7% About three fourths of the patients with unilateral disease used little or no support when walking However only 2 of 33 patients with bilateral arthroplasties walked without some support for one hip or the other Of the entire group 30% used no support 34% used a cane part

time, 21% used a cane full time and 15% used crutches.

Only 12 patients in the entire group were unable to sit comfortably for 1 hour About two-thirds had been unable to sit comfortably before operation About two-thirds were able to go up stairs one foot after the other after operation and about half were able to squat Limping was the rule in patients with bilateral arthroplasty but about 50% of those with unilateral hip disease had little or no limp

Arthroplastic hips in patients with unilateral disease had much freer motion than those in patients with bilateral disease only 10% of patients with unilateral disease had less than 50% useful range of motion Flexion deformity in excess of 15 degrees was present in 60% of patients with bilateral hip disease but in only 17% of those with unilateral disease Ankylosis of the involved hip occurred in only 3 patients in the entire group

Major supplemental surgery was necessary in 9% of patients with unilateral arthroplasty and 24% of those with bilateral arthroplasty Indications for supplementary surgery were persistent pain loss of motion instability and persistent sepsis. None of the revised hips was rated excellent 19% were good 58% satisfactory and 23% unsatisfactory This represents a salvage rate of 77%

Dermal Arthroplasty of Hip Joint can be carried out successfully according to James W Kelley and Worth M Gross[2] (Tulsa Okla.)

Technic.—After proper surgical preparation of the skin of the abdomen and the involved hip a split thickness graft is taken with the Padgett dermatome. It is left attached to one lateral border after being removed from the drum. The dermis or cutis with a small amount of fat is excised and after proper hemostasis the split graft is sutured over the resulting defect, which allows for removal of a large dermal graft with immediate coverage of the donor area The hip joint is approached through a Smith Petersen or Gibson incision and the involved area exposed. The capsule is resected along with the osteoid tissue on the head and neck of the femur but the shape of the articular surface of the head is left intact to allow it to retain its natural form. The acetabulum is not touched The femoral head is dislocated and the dermal graft is applied over it. The graft is held in place with a circumferential suture of no 36 wire and the edges are sutured to the remaining parts of the capsule. The femoral head is reduced back into normal position and the wound is closed.

The patient is placed in a Balkan frame or some other type of immobilizing apparatus for 14 days, which allows movement of the an-

(2) Plast. & Reconstruct. Surg 23 540-546, May 1959

lle, toes and knee but no movement of the hip Gradual movement of the involved hip follows but the patient remains on crutches with no weight bearing for 4 months. After that, the patient uses a walking stick, but even it may eventually be discarded

This technic was used in the surgical treatment of a man aged 40 who had a sore left hip for 5 years after an accident Follow up of 1½ years after surgery showed that the left leg had flexion of about 90 degrees normal external rotation of 70 degrees normal internal rotation of 50 degrees and there was no pain in the hip joint. There was slight soreness on weight bearing but he was no longer using crutches merely a cane for walking The patient has long since returned to his regular work and does not complain of any pain in the hip joint.

Hip-Joint Prosthesis—Sovereign Remedy or Profligate Tool? Jack Wickstrom Edward T Haslam and James T Kerr[3] (New Orleans) analyze results in 44 patients with hip fractures who had been treated with endoprostheses In 39 hip prostheses were inserted because of pathology arising from fracture of the femoral neck Three had radiation necrosis of the femoral head secondary to carcinoma of the cervix and 2 had aseptic necrosis of the femoral head All prostheses used were of the Fred Thompson type except for two of the Vaden Reith type

Operative mortality was 9 1% (4 patients) Death from causes not related to surgery occurred in 7 (16%) patients during the follow up Results in 24 (54 5%) were good These were able to ambulate without assistance or disabling pain or with use of a single cane to add stability to their gait or prevent limp Six (13 6%) patients with fair results had some disabling pain or limitation of hip motion In 14 (31.8%) patients the operation failed they were unable to ambulate after surgery Of these 6 were unable to walk because of conditions other than hip-joint disability indicating that more careful consideration of indications for surgery might have eliminated or reduced the number of failures

The claims and counterclaims originally advanced by proponents and opponents of replacement arthroplasty of the hip must be tempered in the light of more mature consideration Several claims of superiority must be examined more

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3 J Louisiana M Soc 111 51 55 February 1959

closely before endorsement This is especially true in fresh fractures of the femoral neck The claim that prosthesis insertion is less traumatic and time consuming is not substantiated by comparison of comparable cases with closed reduction and internal fixation and those of prosthesis insertion Mortality among those in the group with prosthesis was similar to that reported after reduction and internal fixation of femoral neck fractures The claim of superiority of the endoprosthesis in affording early ambulation is probably tenable but many of these patients require considerable training and assistance in walking

Use of a femoral prosthesis is indicated in fractures with comminution of the neck fragmentation of the head or with such advanced osteoporosis that secure fixation of the head fragment with pins or nails is impossible Use of the prosthesis in pathologic fractures associated with malignancy or after radiation necrosis also is rational Use of prostheses in patients whose convalescence cannot be controlled postoperatively is acceptable though 2 of 6 psychotic patients in the present group refused to use their endoprostheses after successful reconstruction

Five Year Follow up Study of Ischiofemoral Arthrodesis in 16 patients was carried out by John W Miller[4] (Louisville, Ky) Of these 13 had tuberculous arthritis of the hip 2 had undiagnosed destructive arthritis and 1 had congenital dislocation of the hip In 11 Brittain procedures were done and in 5 Trumble procedures In 1 of the Trumble procedure and in all of the Brittain procedures autogenous bone was used for grafts Because of the relatively higher incidence of failure of fusion among patients when bank bone was used, *autogenous bone should be used for the graft in this type of operation* Also because of the higher incidence of failure among patients under age 11 these procedures are better reserved for those patients beyond that age No consistent correlation could be established between the rate of success and (1) duration of the disease (2) sex (3) duration of immobilization (4) frequency of cast change (5) use of antituberculous drugs (6) presence of tuberculous lesions elsewhere in the body or (7) previous hip surgery

The important complications were hip deformity shortening of the affected extremity and instability and/or knee

(4) J Kentucky M A 57 438 441 April, 1959

deformity All 7 patients with solid hips had flexion deformities of the hip ranging from 20 to 38 degrees Four had adduction deformity in addition ranging from 5 to 20 degrees. With 1 exception shortening in the affected extremity ranged from 1/4 to 3 1/4 in

In all 7 patients with solid hips, the knee of the affected extremity was unstable. This was most often a lateral instability, but was often combined with rotary and anteroposterior instability Those with the greatest instability also have x ray findings of distortion of the femoral and tibial condyles and enlarged distorted and lengthened upper end of the fibula Of the 7 patients 4 had knee deformity in addition to instability This deformity was one of flexion valgus external rotation or a combination of these.

Failure of fusion occurred in 5 patients 2 of whom had subsequent successful iliofemoral procedures which were done 10 and 12 months after ischiofemoral arthrodesis They were subject to the same type of complications postoperatively as were the patients with successful ischiofemoral fusions

Surgery of Hip There is no general agreement on how best to achieve a bony ankylosis There are five recognized methods (1) Watson Jones arthrodesis with joint erasion and internal fixation with a trifin nail (2) McKee arthrodesis with joint erasion and internal fixation with a lag screw (3) Pyrford arthrodesis which is essentially a modified Watson Jones procedure with in addition a subtrochanteric osteotomy (4) Norwich V arthrodesis, and (5) Charnley central dislocation

J S Batchelor[5] (London) found that stability is greatly improved by a subtrochanteric angled osteotomy The combined procedure of excision and osteotomy has been performed as a two- or one stage procedure. In the two-stage procedure the Smith Petersen approach is used for excision of the femoral head and neck and 2 weeks later osteotomy is performed through a posterolateral approach In the one stage procedure the operation is performed through an anterolateral approach between the tensor fasciae femoris muscle and the gluteus medius and minimus This gives good access to the hip and when extended distally to the upper end of the femur Resection of the head and neck should start just

(5) Proc Roy Soc. Med. 5 355 360 May 1959

above the lesser trochanter and pass upward and outward along the intertrochanteric line The cut surface of the great trochanter should be quite smooth, and osteophytes should be removed from the acetabular brim Bony irregularities cause pain and a revision operation may be needed to remove them

The osteotomy must be performed ½ ¾ in below the lesser trochanter and a locking osteotomy is used to prevent



Fig. 136 (left) —Successful excision-osteotomy
Fig 137 (right) —Unsuccessful osteotomy Inadequately angled and small weight bearing area.
(Courtesy of Batchelor J S Proc. Roy Soc. Med. 52 355-360 May 1959)

displacement. Judging the correct angle of the osteotomy is important and difficult best results are achieved when the distal fragment is abducted about 40 degrees producing a block to adduction Internal fixation is provided by an angled plate Postoperative treatment consists in Russell traction for 6-8 weeks and full weight bearing is allowed when there is x ray evidence of union of the osteotomy

Trueta has suggested that the osteotomy produces bone rubbing and pain This has not been the author s experience when the operation is correctly performed The essential features are stability by adequate angulation distribution of

weight over a wide area on the upper femoral fragment and smooth bony surfaces (Fig 136) Many poor results are due to inadequate angulation of the osteotomy and weight bear ing on a limited area of the upper fragment (Fig 137)

► [In this paper, Mr Batchelor reviewed a number of procedures in sur gery of the hip, but the interesting part to me was the presentation of the "angled osteotomy" This is a salvage procedure, as the author admits, but the thought occurred that this was likely one way of salvaging a hip following failure of the insertion of a hip prosthesis. Certainly many hip prostheses are being inserted today and not all of them are proving satis factory With removal of the prosthesis it is still difficult to arthrodese a hip and it may be that the "angled osteotomy" has a place in the sal vage of this type of joint.—Ed.]

Treatment by Bone Grafting of Aseptic Necrosis of Femoral Head and Nonunion of Femoral Neck (Phemister Technic) Michael Bonfiglio and Maxwell B Bardenstein[6] (State Univ of Iowa) used autogenous cortical bone grafts in treat ment of 53 patients with varying amounts of aseptic necrosis

ANALYSIS OF X RAY RESULTS

	Restoration of Bone Union Femoral Neck and Head		Graft Fracture	Further Collapse Necrotic Femoral Head				Degenerative Joint Change			
	Union	Failed		None	Minimal	Moderate	Severe	None	Minimal	Moderate	Severe
Non-union of the femoral-neck fracture with minimal aseptic necrosis	11	2	2					8	4 (2 preoperativ)	1	
Non-union of the femoral-neck with aseptic necrosis of the femoral head	20	3	2	14	5	2	1		9 (3 preoper tiv)	d	3
Aseptic necrosis of the femoral head				1	2		1		2 (16 preoperative)	16	3
Sub-totals				31		2	2	15	15	19	0
Totals	31 (87%)	4 (11%)	4	41 (74%)		11 (26%)		15 (27%)		40 (4%)	

of the femoral head. Some of the patients also had nonunion of fractures of the femoral neck By means of two-plane roentgenographic control two grafts were placed in the su perior anterior quadrant of the femoral head to support the area most vulnerable to collapse Grafts alone were used in patients with union of the fracture and aseptic necrosis or ne crosis from other causes Three 5/32 in Steinmann pins were inserted below the grafts as additional fixation when nonunion was present

(6) J Bone & Joint Surg 40-A 1329 1346, December 1958.

Functional ability pain, deformity gait and range of motion were considered in evaluating results of treatment Other factors considered were x ray evidence of bone union arrest of further collapse of necrotic bone and secondary degenerative arthritis (table) Satisfactory results were achieved in 11 of 13 patients with minimal to moderate aseptic necrosis of the femoral head and nonunion of the neck in 16 of 22 with more severe aseptic necrosis and nonunion and in 14 of 20 with aseptic necrosis alone In 4 patients unsatisfactory results could be ascribed to improper placement of the cortical transplants and in 3 early weight bearing before reconstitution of the head and neck contributed to failure. There were no operative deaths Infection occurred in 3 patients

The results indicate that the procedure is effective in restoring continuity to the ununited femoral neck fracture and viability to the necrotic femoral head in enough instances to warrant its consideration in management of these complications The procedure is now being done at the authors hospitals as soon as x ray evidence of loss of position of fracture fragments insecure internal fixation or density changes in the femoral head indicating aseptic necrosis occur The procedure is not advised if the patient is physiologically old or unable to walk with crutches

Pathogenesis of Disintegration of Hip in Sickle Cell Anemia. The x ray appearance of hips damaged by sickle cell anemia often resembles aseptic necrosis observed after fractures of the femoral neck Because of this it has been assumed that the pathogenesis of the two conditions is the same i e total death of the head (due in the first instance to *mechanical disruption of the major vessels and in the* second to occlusion of major vessels by thromboses of sickled cells) followed by partial replacement and consequent breakdown Yet it has been noted repeatedly at autopsy that thromboses of large vessels are conspicuously lacking in those who die during sickle cell crisis The areas of increased density of bone which have been labeled infarcts often do not correspond to any known distribution of arterial supply

Mary Sherman[7] (Ochsner Clinic) studied x ray and pathologic changes in 3 patients with hip disease due to sickle cell anemia

(7) South. M J 52 632 637 June 1959



Fig. 138.—Pelvis shows superior central portion of left femoral head is much denser than rest of bones. It is separated from them by radiolucent area. (Courtesy of Sherman, M.: South. M J 52 632-637 June, 1959)



Fig 139—Cut head shows dense central fragment separated from neck by band of tissue that contains pearly white fibrocartilage. Articular cartilage is depressed about margins of fragment. (Courtesy of Sherman, M. South. M. J 52:632-637 June 1959)

CASE 1—Girl 16 had severe pain and limited motion of the left hip The x ray (Fig 138) showed a picture that is often called osteochondritis dissecans. The femoral head was excised and replaced by a prosthesis. The cut surface of the head (Fig 139) showed wrinkling of the articular cartilage about a segment of dense bone, which appeared separated from the rest of the head by gelatinous soft tissue and an underlying zone of sclerosis. Microscopic section substanti



Fig 140.—Microscopic section of femoral head shows gross architecture of separated central fragment is unchanged, as is overlying articular cartilage. Fibrocartilaginous band containing fragments of trabeculae clearly seen as is hypertrophy of bone immediately below it. Elsewhere trabeculae are atrophic, articular cartilage is thin and spaces between trabeculae are full of red marrow (Courtesy of Sherman, M. South. M J 52 632-637 June, 1959)



Fig. 141.—Pelvis on patient admission shows gross changes in right hip. Irregularity in ease in density and breakdown of superior portion of femoral head are present. This x-ray appearance has been called aseptic necrosis of head. (Courtesy of Sherman M South. M. J 52 632-637 June, 1959)

ated this interpretation (Fig 140) The superior segment of bone and cartilage was dead. Beneath it was a zone of fibrous granulation tissue containing fragments of fractured trabeculae. Immediately under the soft tissue the zone of sclerosis was evident, whereas in the rest of the head there was a combination of large areas of necrotic bone and extensive replacement by new living bone.

CASE 2.—Boy 14 had severe pain in the right hip X ray showed considerable surface destruction of the femoral head and distortion of





Fig 142 (top) —Microscopic section through right femoral head shows wrinkled articular cartilage separated from head by zone of fibrous granulations in which are found ground up bone debris and random new bone formation. Beneath fibrous granulations is narrow zone of bone sclerosis. Rest of architecture is relatively undisturbed and there is only one marginal focus of red marrow Edge of articular surface shows thickened synovial tissues.

Fig 143 (bottom) —Superior surface of left femoral head. Missing articular cartilage was completely loosened from bone It was lifted out with forceps. Margins of remaining cartilage show thickened synovial pannus.

(Courtesy of Sherman, M.: South. M. J 32 632-637 June, 1939)

the acetabulum (Fig 141) The left hip was normal Six months after fusion of the right hip the left hip showed narrowing of the articular space gross distortion of the surfaces of the femoral head and acetabulum and a large dense area within the femoral head. During fusion of the right hip a slice through the head was removed (Fig 142) There was a zone of partially organized hemorrhage where the subchondral plate should be. This layer containing ground up trabeculae and erratic new bone formation had separated off much of the cartilage The head showed no necrosis. The marrow was edematous and in addition to capillaries stuffed with sickled red cells, showed infiltration with plasma cells and a large amount of hematopoiesis There were islands of interstitial hemorrhage due to leaks through capillary walls rendered necrotic by the anoxia secondary to plugging by masses of sickle cells The left femoral head was excised and replaced by a prosthesis The articular cartilage was all present, but much of it had been separated from the head (Fig 143) At the margins of the head, the synovial membrane was red and thickened and was beginning to grow across the surface.

CASE 3—Woman 21 died after an automobile accident. She had transient arthalgia during sickle cell crises, but no residual articular symptoms The upper femur was grossly normal Microscopic section showed trabeculae that were thickened but fewer than normal. Everywhere there were infarcts of varying sizes and ages. There was sufficient destruction beneath the articular cartilage so that surface collapse must have been imminent.

From a study of these patients Sherman concludes that breakdown of the hip joint in sickle cell disease apparently depends on several mechanisms all secondary to local damage to extremely small vessels (1) There may be complete interruption of the circulation of the head. This may be followed by the classic picture of creeping replacement and late pathologic fracture at the advancing margins of revascularization (2) Focal hemorrhage that is small enough to be rapidly reorganized may leave no trace in bone If focal hemorrhage is in the subchondral regions it may separate off the articular cartilage. *Nonspecific granulations* contribute to these effects (3) Larger focal hemorrhages in bone may result in persistent infarcts visible roentgenographically Whether they contribute to symptoms and to structural breakdown depends on their location (4) Chronic synovitis also due to focal hemorrhage activates the synovial membrane to grow across the articular surface as a pannus and destroy the cartilage from above

Circulatory Disturbances in Osteoarthritis of the Hip Venographic Study was carried out by Anders Hulth[8] (Aca

(8) Acta orthop scandina 28:81-89 1959

demic Hosp Uppsala Sweden) Fifteen patients with uni or bilateral arthritic hips were investigated

METHOD —A tapered cannula, 10 cm. long provided with obturator and handle, was used Some patients were examined under general anesthesia in connection with operation on the hip In others local anesthesia was used. The cannula was inserted from the front through a small cutaneous incision. After palpation of the femoral artery and determination of the proper direction, the cannula was hammered into the head for about 1 cm. Usually 6-8 cc. contrast medium was injected.

In patients with normal hips venography reveals circumflex veins but in osteoarthritis evacuation of dye from the femoral head occurs mainly via the medullar veins coursing distally into the femoral shaft. In the normal hip the dye disappears within a few minutes in the arthritic hip dye accumulates in the head of the femur with retention for 15 minutes or more In osteoarthritis the injection meets with greater resistance than normal The injection is almost painless in the normal hip whereas in osteoarthritis it is painful This may be explained by the resistance to injection offered by the pathologic cancellous tissue Dilatation of intraosseous vessels which are abundantly supplied with nerve fibers also may possibly account for the pain caused by injection into arthritic bone

Effects of Rotatory and Valgus Malpositions on Blood Supply to Femoral Head Observations at Arthroplasty Frank B Smith[9] (Portland Ore) studied the blood supply to the femoral head during 56 open hip operations of different types In 33 of 44 operations (70%) in which the femoral head was removed, some gross bleeding occurred when the ligamentum teres was cut. In the course of 24 reconstructive operations femoral head fragments were checked for bleeding Though some heads had residual shreds of retinacular attachments none had patent retinacular circulation Before testing of the capital fragments any residual retinacular attachments were destroyed Bone was then removed from the capital fragment bit by bit with a rongeur until active blood supply was tapped Four fragments were avascular 12 bled sluggishly and 8 bled actively The 8 heads that bled freely were then studied for the effects of various malpositions on their bleeding activity Anterior or posterior rotatory malposition interrupted active bleeding from the fragments Of

(9) J Bone & Joint Surg 41 A:800-815 July 1959

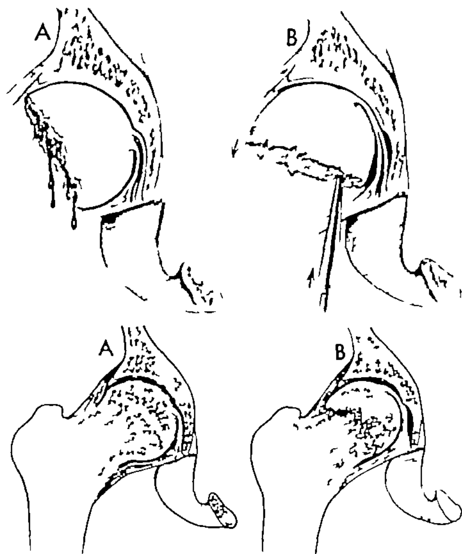


Fig. 144 (top) —Coronal section of acetabulum containing symmetrical head fragment. *A* actively bleeding head; ligamentum teres and open foveal vessels in anatomic position in fossa; no rotation of head and no twisting or stretching of ligament. Situation comparable to sitting or quadruped position. *B* bleeding stopped by tilting head fragment in extreme valgus position. Ligamentum teres and its vessels have left fossa superiorly are overstretched and re compressed between lunate surface of acetabulum and femoral head.

Fig. 145 (bottom) —*A* coronal section of intact hip showing normal relation of ligamentum teres to acetabular fossa. *B* similar view of subcapital fracture with head fragment in extreme valgus position. Ligamentum teres insertion has left fossa superiorly is overstretched and is compressed between lunate surface f acetabulum and femoral head. This position from initial impaction or elective nailing could result in avascularity of head.

(Courtesy of Smith F B. J Bone & Joint S rg. 41 A 800-815 July 1959)

the nonrotatory malpositions only extreme valgus position consistently interrupted bleeding (Fig 144) Moderate degrees of valgus position caused partial interruption of bleeding but slight valgus position had no effect

Related anatomic studies were carried out on fresh cadaver specimens to determine the effects of normal and abnormal ranges of femoral head movement on the ligamentum teres and its foveal vessels These studies indicated that in the intact hip it is impossible for the ligamentum teres to become sufficiently twisted stretched or compressed to interrupt its supply of blood to the femoral head In the fractured hip abnormal degrees of rotation of the free femoral fragment can easily result in twisting stretching and compression of the ligamentum teres to the point of complete interruption of its blood supply Rotatory malposition may be present and yet not be noted in an otherwise anatomically reduced fracture. Extreme valgus position interrupts foveal blood supply (Fig 145) and should be avoided Fixation of subcapital fractures in either rotatory malposition or extreme valgus position could account for many instances of delayed union non union aseptic necrosis and degenerative arthritis If so detection and correction of these malpositions should be added to the criteria of management.

Use of McMurray's Osteotomy in Osteoarthritis of the Hip has increased in recent years after a period of lost popularity according to G S Tupman.[1] The operation is comparatively simple to perform and is not a shocking procedure It will correct deformity such as adduction and flexion while increasing stability and decreasing the stress thrown on the joint Thus the operation is ideal for the painful arthritic hip in the older patient

In McMurray's original osteotomy the chief purpose was to provide support for the pelvis through a femoral shaft that was displaced medially after intertrochanteric osteotomy Other authorities however have considered that for lasting benefit with improved stability and corrected deformity the ideal should be a combination of displacement and abduction of the lower fragment. It is important therefore before operation to assess the amount of adduction possible in the hip so that adequate abduction of the lower fragment can be afforded Displacement without abduction often leads to in-

(1) Rheumatism 15 16 1 January 1959

creasing adduction at the osteotomy site with apparent shortening limp and recurrence of instability the chief cause of the relentless deterioration of the osteoarthritic hip

By the production of coxa valga in the joint a new pressure area of articular cartilage of the femoral head takes the place of the old degenerate cartilage Many authorities believe that this is the reason for the success of the operation in providing relief from pain However in view of the fact that mere division of the bone by osteotomy gives immediate relief from joint pain before the osteotomy is united and the patients starts weight bearing it is more likely that decompression of the congested bone is a major factor in pain relief

► [The long term end result of McMurray osteotomies has not yet been established. It is true that the immediate results are quite good and it may be that the long term end results will likewise be satisfactory The only question I would like to ask is "Where do we go from here in case the McMurray osteotomy does not work out?" It may be that this would be another instance in which the Batchelor angled osteotomy might prove of benefit.—Ed.]

Trochanteric Bursitis Management. Robert M Krout and Thomas P Anderson[2] (Mary Hitchcock Mem'l Hosp Hanover N H) reviewed from the standpoint of total management data on 50 patients with chronic or subacute trochanteric bursitis All fulfilled at least the first two of the following criteria for diagnosis of trochanteric bursitis and in most instances at least one of the others (1) history of intermittent aching pain in the lateral aspect of the hip or radiating to this area from the back or knee (2) tenderness about the greater trochanter usually over the posterior superior aspect overlying the tendinous insertion of the gluteus medius (3) radiation of pain down the lateral rather than the posterior aspect of the thigh (4) pain on extremes of abduction or internal rotation of the hip and (5) pain on strong contraction of the hip abductors Weakness of one or more hip groups and limitation of hip motion were infrequent and when present were often caused by an associated condition Calcification in the soft tissues around the greater trochanter as demonstrated by x rays occurred in less than one fifth of the patients

All but 4 received a combination of two or more forms of treatment which were correction of associated disorder bed rest controlled limitation of activities short wave dia

(2) Arch Phys Med 40 8-14 January 1959

therm x ray therapy local injection, nerve blocks and appropriate home treatment Mean duration of trochanteric bursitis after initiation of treatment was 12 weeks Among patients with associated disorders, duration of the disease was longer than among those without such disorders Under this management 90% of the patients improved 62% with complete relief from signs and symptoms In 72% of the patients in whom the bursitis was secondary to or associated with some other condition there was definite correlation between the bursitis and correction of the associated disorder When the associated disorder was not treated or was unsuccessfully treated the bursitis persisted

X ray therapy alone was inadequate but when used with other therapeutic modalities, it may be of some benefit

► [Trochanteric bursitis can be a disabling condition and, judging from the number of methods used in treatment, no one method is satisfactory In my experience x ray therapy has not proved of great value and I treat most patients with an injection of 37½ mg hydrocortisone diluted in about 6-8 cc. of 1% xylocaine. Although this treatment is not specific and not always successful it does relieve a great many patients of their symptoms.—Ed.]

Surgical Treatment of Injuries to Ligaments of Knee is described by Don H O Donoghue[3] (Oklahoma City) If complete severance of any single ligament or of any combination of ligaments of the knee can be demonstrated surgical repair is mandatory Repair should include all ligaments involved It makes little sense to go to the trouble of repairing the collateral ligament and ignoring the cruciate because it adds to the severity of the operation or is 'too difficult or may not be essential " The cruciates are not vestigial they may be vital for adequate function Late cruciate reconstruction is highly speculative and should be done only when the stakes are high as e g in a professional baseball player who is unable to play because of anteroposterior instability Early cruciate repair is highly successful and should be done as a matter of course It is not unduly technical

In certain patients the ligament may repair spontaneously especially the collateral ligaments The danger is in inability to determine short of surgery in which patient healing will occur with normal length The author actually found at surgery the tibial end of the medial collateral lying in the

(3) J.A.M.A. 169 1423 1431 Mar 28 1959

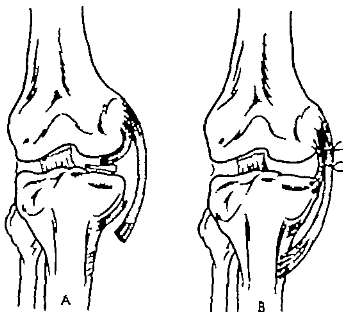
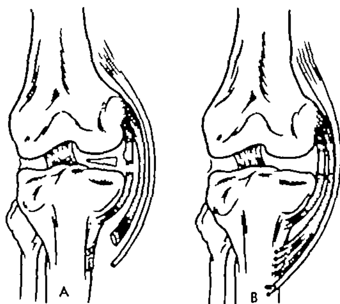


Fig. 146.—Inj ry from rotation-abduction force before (*A*) and fter (*B*) repai . Note deep layer of medial collateral ligament torn from tibial rim and from cartilage and lyi g on top of cartilage, requiring surgery for deep layer to be repaired. Femoral attachment of anterior cruciate avulsed and widely separated. (Courtesy of O Donoghue D H. J.A.M.A. 169 1423-1431 Ma 28 1959)



F g 147 —Classic jury of semitendinosus tendon ttachment pulled loose, with wide separation of ligament attachment before (*A*) and fter (*B*) repai (Courtesy of O Donoghue, D H J.A.M.A. 169 1423-1431 M r 28, 1959)

joint on top of the medial meniscus (Fig 146) The ligament was torn with the ends free and the tendon retracted 1 in or more (Fig 147) The femoral attachment of the medial collateral ligament was located lying in the joint on top of the meniscus (Fig 148) with the femoral end of the posterior cruciate lying over the medial meniscus There are many other such situations that are irredeemable except by sur

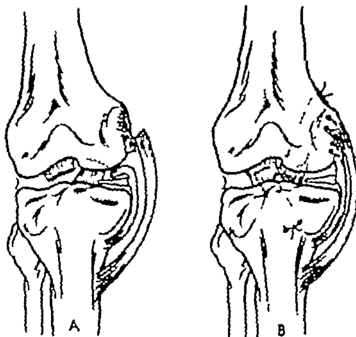


Fig. 148.—External rotation-abduction injury before (*A*) and after (*B*) repair Note tibial attachment of anterior cruciate torn loose and separated, femoral attachment of posterior cruciate pulled away, both layers of medial collateral ligament torn away from femoral condyle and deep layer folding inward and lying on top of cartilage. Anterior cruciate was fastened to tibia, posterior cruciate to femur Medial collateral was pulled away from joint and attached to femur (Courtesy of O'Donoghue, D H. J.A.M.A. 169 1423-1431 Mar 28, 1959)

gery After such pathology is actually observed there is skepticism of obtaining uniformly good results from nonsurgical treatment

After surgery for rehabilitation quadriceps setting and straight leg raising of both legs are encouraged from the 1st day The patient is in a wheel chair 24-48 hours postoperatively He should be able to raise the leg actively splint and all by 48 hours and to walk on crutches in 3 5 days Weight bearing is not permitted however After the solid cast is applied (2 weeks postoperatively) the patient may walk with crutches on a walking heel if progress is good He is permitted to discard the crutches if he feels able to walk around

without them but in general he should use the crutches while away from home. Meanwhile exercise of all other available muscles is encouraged

After the patient has the cotton cast (4 weeks postoperatively) he is urged to walk preferably without the crutches and to continue the exercises At 6 weeks the cotton cast is removed and quadriceps rehabilitation begins in earnest and continues until the circumference of both thighs is equal. Specific written instructions with definite exercises are important. The actual level of activity varies much with the individual patient

Diagnostic Value of Punch Biopsy of Knee Synovium. W M Mikkelsen I F Duff C W Castor H A Zevely and A J French[4] (Univ of Michigan) used the Polley Bickel biopsy instrument (Fig 149) to obtain synovial tissue 207

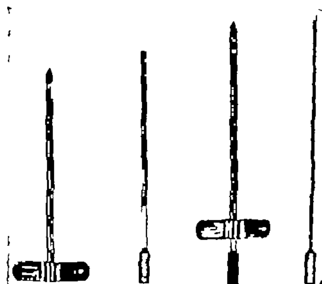


Fig 149 —Polley Bickel biopsy instrument showing outer trocar inner cutting knife trocar and knife assembled and corkscrew-tipped extractor (Courtesy of Mikkelsen, W M., *et al* A M A. Arch. Int. Med. 102 977 985 December 1958.)

times from the knees of 190 patients Incidence of failure to obtain tissue was 5% (10 patients) Punch biopsy was of definite diagnostic aid in 77 (40%) patients In 99 (53%) synovial changes were absent too slight or too nonspecific to suggest diagnosis In 4 (2%) incorrect diagnosis was suggested by biopsy

Synovial changes in most of the patients with rheumatoid

(4) A M A Arch. Int Med. 102 977 985 December 1958.

arthritis (Fig 150) included (1) hyperplasia of the synovial intimal cells often with increased villous formation of the synovial membrane (2) subintimal inflammatory cell infiltration with lymphocytes and plasma cells often with follicle like collections of these cells and (3) increased vascularity congestion and edema This combination of findings, in absence of specific features pointing to some other diagnosis is highly suggestive but not diagnostic of rheumatoid



Fig. 150—Section through synovial villus from girl, 12 showing minimal hyperplasia of synovial cells. Subsynovium shows pronounced congestion and edema, with heavy infiltration of mononuclear inflammatory cells with some focal collections. Changes considered characteristic of rheumatoid arthritis. Hematoxylin-eosin; reduced 10% from ×90. (Courtesy of Mikkelsen, W M et al A.M.A. Arch. Int. Med. 102:977-985 December 1958)

arthritis Similar and indistinguishable changes were observed in most of the rheumatic diseases considered to be possible variants of rheumatoid arthritis

Biopsy was usually of help in differentiating rheumatoid arthritis from specific infectious arthritis osteoarthritis and gout. In osteoarthritis synovial intimal cell hyperplasia and subintimal inflammatory response were usually absent or slight This finding together with a more nearly normal nucleated cell count better mucin clot formation and higher viscosity on examination of the synovial fluid served to differentiate clearly osteoarthritis from rheumatoid arthritis

Urate deposits in the synovium were found in 8 of 23 patients with gout In 5 with pyogenic infection of the knee, considerable necrosis was found in the synovium and the in

flammatory cell infiltrate was predominantly polymorphonuclear Biopsy revealed the causative organism in 1 patient with *sporotrichosis* In 1 of 3 patients with tuberculous arthritis characteristic epithelioid tubercles were found in the synovium

► [Punch biopsy of the knee synovium is a valuable diagnostic procedure and often precludes the more formidable operative procedure of an open biopsy Although many of the biopsies obtained may be negative, it is interesting that the authors found 40% of theirs to be definitely of value diagnostically It is the positive biopsies that are of value and not the negative ones Often if one suspects a serious condition within the knee joint, a negative biopsy is of value.—Ed.]

Fibrous Ankylosis of Extended Knee *may result from traumatic lesions of the knee or adjacent parts* prolonged immobilization of the knee or inflammatory affections in or near the knee C P Van Nes[5] (State Univ of Leyden) describes a surgical technic that makes possible control of the various intra- and extra articular factors impairing knee flexion while maintaining strong active extension

TECHNIC.—An incision is made on the anterior side of the knee. The medial and lateral vastus muscles are detached from the rectus tendon and the patella and the knee joint is opened Adhesions found in the superior recess and in the femoropatellar and femorotibial joints are severed. The intermediate vastus muscle is transversely severed and the adherent quadriceps muscle is detached from the femoral shaft with the aid of a raspatory moved upward. Attempt is then made to bend the knee If the shrunken retinacula preclude a sufficient range of flexion they are detached from the patellar ligament and the femoral and tibial condyles. If the iliotibial tract is contracting this is wedge incised or submitted to Z shape elongation

Another attempt is made to bend the knee by gradual strong pressure. Generally 90 degrees of knee flexion is possible The vastus muscles are provisionally fixed to the rectus tendon at 60 degrees flexion. The knee is stretched the tourniquet removed and hemostasis effected The vastus muscles are sutured onto the rectus tendon and patellar margin in the position determined In this manner an indirect connection is restored between the vastus muscles and the distal part of the leg and the muscles can resume their extensor function The fascia and skin are closed and a pressure bandage is applied with the knee flexed 30 degrees or to the 150 degree position on a curved splint. As soon as the wound permits the leg is placed on an adjustable exercise splint which allows optimal passive flexion of the knee during the day During the night, the knee is restored to its extended position to facilitate sleep Active exercises can be started after a few weeks and weight bearing after 4-5 weeks.

Of 20 patients treated by this method more than 90 de

(5) Arch. chir neerl. 10 357 368 1958

grees' flexion was obtained in 7 patients, 45 90 degrees in 10 and less than 45 degrees in 3

Arthrography in Diagnosis of Meniscal Injuries of Knee Correlation of Roentgenographic, Clinical and Operative Findings Vernon C Turner (Evanston Ill) and Flora Brown Wurtz[6] (Arlington Heights, Ill) performed arthrographic examinations using a water soluble contrast medium in 469 patients Contrast arthrography using 35% Diodrast solution was the method used The Diodrast solution is miscible with the joint fluid and unlike air, can be used in the presence of joint effusion

No absolute contraindications to arthrography have been noted save the obvious one of infection in or around the joint There are, however several situations in which the examination seldom gives satisfactory information of the state of the menisci If pronounced degenerative arthritis is present as disclosed by standard x rays arthrograms are difficult to interpret. A satisfactory examination cannot be done if the knee cannot be extended to at least 170 degrees This block occurs in a bucket handle tear of the meniscus when the handle slips into the intercondylar notch, preventing full extension Arthrography should not be attempted in children because they are unable to cooperate and to lie still during the examination

The arthrographic findings were evaluated in 188 patients Diagnosis by arthrograms was correct in 136 (73%) Of the 52 times that errors were made in interpretation of the x rays 17 were errors of commission i e. damage to a meniscus was thought to be present when in fact none could be found at operation

In 50 knees in which the history and findings were typical of a tear of the medial meniscus diagnosis was correct in 45 (90%) Surgically proved tears of the lateral meniscus were diagnosed by x rays in 30% In none of the 7 patients in whom tears of both menisci were found was the diagnosis of tear of the lateral meniscus made by x ray

Arthrography of the knee is of value in diagnosis of lesions of the medial meniscus particularly in those patients in whom history and physical findings are atypical or only suggestive. In the patient who presents with a locked knee

(6) J Bone & Joint Surg. 41 A 1213-1220 October 1959

and the typical history and findings of tear of the meniscus with displacement arthrography is neither necessary nor helpful In common with most laboratory examinations false positive and false negative findings can be read. The mistaken negative examination is more common than the mistaken positive

The procedure is time consuming and therefore expensive from the standpoint of the x ray department and requires experience in interpretation.

What is Tennis Leg? Tennis leg is a traumatic lesion of the calf with highly characteristic signs and symptoms The condition is generally believed to be due to subcutaneous rupture of the plantaris muscle but Ored Arner and Ake Lindholm[7] (Karolinska Hosp Stockholm) question this view The situation of the symptoms the distinct tenderness and hematoma formation on the medial aspect of the midcalf and loss of power in tennis leg cannot be accounted for by rupture of the belly of the plantaris muscle its musculotendinous junction or of the tendon

The mechanism of injury was analyzed in 20 patients with typical tennis leg In all the calf lesion was caused by sudden dorsiflexion of the foot in pronounced plantar flexion while the knee joint was in extension. In every patient the foot was more or less supinated The movements of serving at tennis are a typical example Immediately after hitting the ball the back foot which is then supinated and in plantar flexion is moved forward while the knee joint is extended In this position the foot suddenly takes the whole weight of the body

Careful palpation of the calf revealed in all a distinct dimple like depression medial to the midline of the calf in a position corresponding to the musculotendinous junction of the medial gastrocnemius belly Examination was at first impeded by edema in some patients but once this had been massaged away the gap at the musculotendinous junction was readily detected. Tenderness was limited to this area

The affected area of the calf was explored in 5 of the patients In each a transverse rupture was found at the junction between the medial gastrocnemius belly and its tendon tissue In 1 the lesion was long standing and the gap was partly filled with scar tissue. This was treated by excision of the scar tissue and suture The others were treated solely with

(7) Acta chir scandinav 116 73 77 1958

suture. The tendon of the plantaris muscle was intact in all 5 patients explored surgically.

Histologic Changes in Subcutaneous Rupture of Achilles Tendon. Study of 74 Cases is presented by Ored Arner, Ake Lindholm and Svante R. Orell[8] (Stockholm). Subcutaneous rupture of the Achilles tendon cannot be explained only on the grounds of its decreased resistance due to the aging process. Such ruptures are fairly uncommon and the traumatic force applied is often relatively slight. The injury is predominant in men and is commonest among patients aged below the 4th decade. Of 92 patients, the ratio of men to women was 79:13; mean age was 38.5. Thus some other factor must be responsible for the changes in the Achilles tendon producing decrease in its resistance which takes place in certain persons. Syphilis, gonorrhea, tuberculosis, gouty arthritis, rheumatic disease and systemic infections are among the etiologic factors that have been suggested. This could not be verified in the present series. It had been found, however, that most of the patients had earlier carried out some form of athletics to a strikingly great extent. The rupture had generally occurred during a period of inactivity.

The authors studied 74 subcutaneous ruptures of the free part of the Achilles tendon operated on from a few hours up to 8 months after rupture. At operation, parts of the tendon tissue beside the rupture site were excised for histologic examination. In every instance histologic examination showed more or less pronounced characteristic degenerative and necrobiotic changes in the tendon tissue. Distinct degenerative changes were found even in the 12 patients in whom operation and biopsy were performed within 24 hours of the rupture. Consequently, the degenerative changes cannot be secondary to the traumatic tissue damage. Degenerative changes in the tendon tissue are a prerequisite for occurrence of rupture of the free part of the tendon.

Inflammation and regeneration appear secondarily to the tissue damage and hemorrhage associated with the rupture and are entirely unrelated to the degenerative process. The inflammatory and regenerative changes permit an approximative histologic evaluation of the age of the injury in the individual patient.

Histologic examination provided no definite information

(8) Acta chir. scandinav. 116: 484-490, 1958-59.

regarding the cause of the degenerative changes in the tendon tissue. Hypertrophy of the media with narrowing of the lumen in medium-caliber vessels was present in some patients but no other vascular changes of importance were observed No signs of specific inflammation or tumor were present in any patient The histologic picture was compatible with the assumption of impairment of the blood supply as the causative factor

Subcutaneous Rupture of Achilles Tendon Study of 92 Cases is presented by Ored Arner and Ake Lindholm[9] (Karolinska Hosp Stockholm) Patients were aged 23 72. Almost all participated in sports In most cases injury appeared to have resulted from (1) pushing off with the weight bearing forefoot while extending the knee (2) sudden unexpected dorsal flexion of the ankle or (3) violent dorsal flexion of a plantar flexed foot.

At the time of accident the patient usually has sudden intense pain in the region of the distal portion of the Achilles tendon However pain may be slight or absent. Usually there is inability to walk or even to support the body on the foot. If pain is slight, the patient may be able to walk on the foot but *will be unable to stand on the toes* Clinical examination shows the soft tissues immediately above the calcaneous to be increased in breadth. In recent cases there is usually a clearly perceptible depression 3-6 cm proximal to the calcaneous and the gap in the tendon can be palpated. The ability to flex the foot in a plantar direction without resistance may be normal but against resistance a marked loss of power is noted X rays reveal pathognomonic changes in the distal tendon contours (Fig 151) If the patient is examined after several weeks it is more difficult to palpate an interruption in the continuity of the tendon because the gap is filled with organized hematoma In these cases the bulges of the proximal and distal tendon ends are more striking (Fig 152)

Of the 92 patients 6 were treated conservatively and 86 underwent operation Among those treated conservatively the result was good in 1 and poor in 5 Walking was particularly affected Results were good in 79 patients treated surgically and poor in 3

(9) Acta chir scandinav., supp 239 1959



Fig 151 (left) — Characteristic appearance of subcutaneous rupture of Achilles tendon. Posterior tendon contour bulges backward at upper margin of calcaneus, and anterior tendon contour deviates forward above calcaneus.

Fig 152 (below) — Old rupture of Achilles tendon. Proximal and distal tendon ends bulge.

(Courtesy of Arner, O and Lindholm, A Acta chir scandinav supp 239 1959)

The rupture was found to be total in all 86 patients who underwent operation In all of 64 cases in which tendon tissue was examined histologically degenerative and necrobiotic changes were found The changes appeared to be primary and not secondary to injury Since more than half the patients were under age 40 the degenerative changes could not have

resulted solely from advancing age Increased strain placed on the tendon by violent exercise may cause vascular disturbances which give rise to degenerative and necrobiotic changes in the tendon tissue Subcutaneous rupture of the Achilles tendon cannot be induced by indirect violence, if the tendon tissue is healthy If rupture is to occur the tendon tissue must be affected with degenerative changes

Treatment of Symptomatic Calcaneonavicular Anomalies of the Foot is discussed by F S Webster[1] (Lincoln Neb) When calcaneonavicular and talocalcaneal anomalies of the

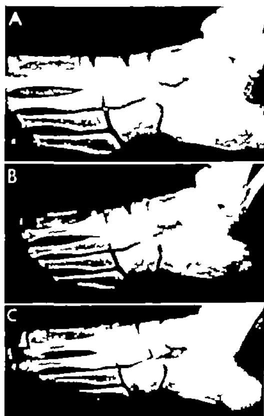


Fig 153 – Foot with calcaneal scaphoid anomaly *A* before excision *B* immediately afterward and *C* 3 years later (Courtesy of Webster F S Surg Gynec & Obst. 107 758-764 December 1958.)

foot do not become symptomatic until after the adolescent period and symptoms develop only after trauma they usually respond to conservative measures The surgical approach to these anomalies may differ In the former when symptomatic the only satisfactory surgical procedure is

(1) Surg., Gynec. & Obst. 107 758 764 December 1958

complete subtalar triple arthrodesis In the latter, however initial surgery need not be radical if the cause is recognized early, before onset of degenerative and osteoarthritis changes In such cases simple excision of the congenital anomaly between the anterior process of the calcaneus and the lateral aspect of the scaphoid (Fig 153 A C) is sufficient to give dramatic and often permanent relief This is probably so because of the less rigid fixation of the anterior synchondrosis and because irreversible changes are not yet present. There is much greater freedom of talar motion though the midtarsal element with inversion movement is limited. It should naturally be ascertained that both anomalies are *not present in the involved foot as may occasionally* occur This can usually be determined clinically but posterior oblique films of the foot may be advisable not only to eliminate the possibility of the second anomaly but also to determine the condition of the subtalar articulation

Talocalcaneal anomalies however may never become symptomatic as they are occasionally discovered in the adult without symptoms or pain Though a radical approach may be necessary, surgical excision of the calcaneonavicular bar may be simple and yield such gratifying results that it is definitely the method of choice as the primary procedure in selected cases If a simple excision will give permanent relief without altering the dynamics of the foot it should be done Arthrodesis can be undertaken subsequently if required However in children with symptoms for some time or with definite evidence of arthritic change a more radical initial operation will probably be necessary

These anomalies usually become symptomatic about the age of puberty during a physiologic phase of active bone development. Rigid calcaneal valgus deformities which do not respond to treatment are occasionally seen in younger children However they are difficult to demonstrate and will certainly show secondary changes at puberty Even though most children with this anomaly before adolescence continue to have intermittent difficulty pain and peroneal spasm have completely subsided in some after conservative methods of rest and immobilization Children with no history of previous known difficulty in this early age group should therefore first be given conservative treatment for a trial period. If there is an exacerbation of symptoms and no re

sponse to treatment excision should then be done. procedure is surprisingly simple and caused prompt matic and lasting relief in 5 of 7 patients operated on.

Orthopedic Diseases of Foot. According to W Marqu (Stuttgart, Germany) the three most important etic factors in orthopedic diseases of the foot are ill fitting s overloading of the sole and painful joint movements worn-out shoe is a true mirror of the foot, revealing the functions of the feet better than the usual methods c amination The worn-out shoe is a diagnostic aid. The s imprint on the inner surface of the sole, the wearing o the lining the folding pattern of the upper shoe anc wearing off of the heels and soles present important diag tic clues However the doctor must clearly distinguis tween changes that are due to poor construction of the and those due to functional shortcomings of the foot.

If the individual needs of a foot are not met by the mak of a shoe so-called shoe conflicts will develop Among th cal shoe conflicts there is first the so-called Haglund This is an otherwise normal heel with a pronounced post upper corner of the calcaneus The heel is wider in the u than lower part and gets into constant conflict with the terior part of the shoe Through continuous rubbing j swelling and finally bursitis develop This conflict ma helped by shoes made to order or by surgery Surgery sists of chiseling off the upper outer corner of the calcar

A common shoe conflict is caused by a prominent hor the navicular bone The horn is also called external t bone *Its prominence is often at the height of the upper r* gin of the shoe and leads to constant rubbing This may to bursitis This condition can be remedied by choosing b with an upper margin that is below or above the external ial bone Surgery is rarely needed Another common s conflict is due to a hump on the back of the foot. The hum caused by a protrusion of the joint margin between the cuneiform and 1st metatarsal bone Pressure from the sl string may lead to painful bursitis in this area

Overloading of the foot or reduction in the load-carry surface of the sole will lead sooner or later to foot insu ciency Such decrease in carrying surface is noted in equinus and also in clubfoot. These abnormalities have tc

1 Deutsche med. Wchnschr 83 2229 2336 Dec 12 2279-2285 Dec. 19

corrected Severe loading insufficiency of the foot may develop due to atrophy of the fat pad of the sole. This atrophy may be congenital however it is much more common in the aged as part of the aging process In advanced forms of atrophy there is only a thin layer of skin covering the bone and the sole is tender to touch Such atrophy may be due also to prolonged use of shoe supports

Hallux Valgus in Adolescents can be treated successfully only by operation J A Cholmeley[3] points out that whatever operation is performed the function of the foot must not be interfered with and the surfaces of the metatarsophalangeal joint must not be encroached on or damaged

Most operations for correction of adolescent hallux valgus include at least an osteotomy of the 1st metatarsal Rocyn Jones described a specially designed osteotomy of the proximal part of the shaft of the 1st metatarsal to correct the metatarsus primus varus but relapse of the varus was common particularly when growth was not complete at time of operation If osteotomy of the proximal end of the 1st metatarsal is to maintain correction of the varus deformity a bone graft must be inserted as is done in the Stamm operation.

Hohmann described a transverse or oblique osteotomy of the neck of the 1st metatarsal Peabody modified this operation by formation of a lateral peg on the distal side of the osteotomy displacing this laterally and fixing it by a catgut stitch through drill holes Hawkins *et al* modified Peabody s operation by specifically removing a transverse section ⅛ in thick from the medial side of the metatarsal neck, leaving a lateral peg as did Peabody A similar operation was described by Mitchell *et al*

In a group of 535 patients with hallux valgus Mygind obtained best results by an oblique osteotomy of the 1st metatarsal close to the head which was displaced laterally and plantarward on the shaft and kept in place by the hole and peg method of Thomasen Cowie was disappointed with many of the results obtained with this method due in his opinion to too early weight bearing in plaster If weight bearing even in plaster is avoided for 4 weeks the results are more uniformly satisfactory The operation can also be carried out with safety in children in whom the epiphyses have not united and in adults with no gross radiologic ar

(3) Proc. Roy Soc. Med. 51:903-906, November 1958.

thritis The foot is immobilized in plaster for 8 weeks but weight bearing is permitted during the second 4 weeks For final removal of the plaster the patient is re hospitalized *for about 1 week* when foot and toe mobilizing exercises are taught and the patient is trained in correct walking The main advantage of the operation is that it corrects the met atarsus primus varus and the hallux valgus without inter fering with the metatarsophalangeal joint.

Weight Stream in Charcot s Disease of Joints Cure of Perforating Ulcer of Foot According to Michael Burman and Walter Perls[4] (New York) perforating ulcer of the foot is often associated with neuropathic arthropathy of the meta tarsophalangeal or interphalangeal joint (Charcot s joint) *but there may be ulcer without arthropathy or arthropathy* without ulcer The neuropathy that results in perforating ul cer may be any neurologic lesion manifest or not that causes imbalance in the foot especially a cavus or cavovarus de formity or fixed metatarsal equinus There is an occult sen sory defect that becomes evident when there is pressure concentration of the weight force anteriorly displaced by reason of the foot deformity *It is uncommon to find perfo* rating ulcer in the typical site beneath the metatarsal heads in Charcot s disease of the ankle or back foot.

The weight force in a balanced foot causes only keratini zation of the anesthetic skin under the 1st and 5th metatar sal heads In the unbalanced foot, there are three sites of neuropathic ulceration (1) the weight force must be con centrated on a metatarsal head by fixed equinus *before ul* ceration can occur there (2) In cavovarus an ulcer may de velop under the convexity of the cuboid bone and styloid process of the 5th metatarsal bone. (3) The toe may ulcerate if there is a plantarly deflected bony outgrowth that follows bone absorption If there is no exostosis there will be no ulcer

Intradermal infiltration by blood or serum in the horny callosity beneath the toe or metatarsal head is the first stage in ulcer formation Prevention of ulcer is possible by tangen tial cutting of the calloused skin to drain it of serum or blood Infiltration in depth when free drainage is lacking leads to ulceration and secondarily osteomyelitis of the adjacent bone

(4) Bull. Hosp. Joint Dis. 19:31-46, April, 1958.

Cure follows the reverse path—a balanced foot relief from infection and resection of bony prominences underlying the ulcer Protection against concentrated weight bearing is needed Ulceration under the styloid cuboid and toe is more easily treated than ulceration under the metatarsal head

Ingrown Toenail Result of Weight Bearing on Soft Tissue was studied by Kermit O Vandenbos and Warner F Bowers[5] (U.S Army Hosp San Francisco) The term ingrown toenail is unfortunate in that it incriminates the nail as the causative factor and is responsible for the fact that most operative and conservative treatments are directed toward the nail Persons with this condition have an unusually wide area of tissue medial and lateral to the nail and with weight bearing this tissue tends to bulge up around the nail When such persons trim the nails in a curved or rounded fashion instead of straight across further bulging of soft tissue is allowed and as the nail grows pressure necrosis of the soft tissue occurs

The authors treated 55 patients 12 of whom had both great toes involved

METHOD—Patients with severe purulent infection of the soft tissue are treated with local saline soaks or wet dressings and bed rest for a few days until the inflammation has partially subsided. Under general nitrous oxide and oxygen anesthesia or under field or local procaine block anesthesia, the toe is cleansed with soap and water All soft tissue on the involved side of the toe is excised starting at the edge of the normal nail and leaving the nail intact. The excision must be generous and adequate often exposing a portion of the lateral aspect of the distal phalanx of the toe. The excision extends at least 0.5 cm. behind the level of the nail base and is carried out completely to the end of the toe. Any prominent bleeding vessels are clamped and tied with fine gut sutures When the excision is done adequately there is often a skin and soft tissue deficiency measuring 1.5×3 cm. This open wound is covered with fine mesh gauze, then bandaged. The patient soaks the bandage from the raw area 24-48 hours postoperatively and repeats this soaking 3-4 times a day as the wound gradually epithelizes from the periphery inward. Daily bandaging is not necessary Most patients are able to wear loose fitting shoes within 2 3 weeks. The end result is a healed toe with little or no lateral or medial soft tissue and a normal nail.

A complication that required rehospitalization and additional treatment occurred in only 1 patient There were no recurrences

Youth, 19 had been unable to perform infantry duty for 3 months because of severe unguis incarnatus of the right great toe. Medial and

(5) U.S. Armed Forces M J 10:1168-1173 October 1959

lateral soft tissues of the toe were removed surgically and he was able to return to duty in 3 weeks. He was rehospitalized 7 months later because of a tender raised keratotic growth 4 mm. in height and 1 cm. in diameter covering a portion of the medial aspect of the re-epithelized toe. The keratotic area was excised and the wound was allowed to reepithelize.

THE NECK SHOULDER AND ARM

Roentgen Findings in *Asymptomatic Cervical Spine.* Frederick Elias[6] (Monticello N Y Hosp) studied lateral cervical views of 102 patients with asymptomatic cervical spines There were no abnormal findings in 24 patients aged 29 or less and in 18 of 21 patients aged 30-40 Three patients in the latter age group showed minimal osteophyte formation Spines were normal in 18 of 32 patients (56%) aged 40-50 Seven showed osteophyte formation limited to the anterior surfaces of the bodies of the 5th 6th and 7th cervical vertebrae and some narrowing of the intervertebral spaces The other 7 showed minimal osteophyte formation limited mostly to the bodies of the 5th 6th and 7th cervical vertebrae. Only 2 of 25 patients over age 50 showed normal cervical spines In 18 there was narrowing of the intervertebral spaces between the 5th and 7th vertebrae Seven patients showed sclerosis of the articular surfaces where narrowing of the intervertebral disk occurred. Four patients showed osteoporosis 14 minimal to extreme osteophyte formation 4 calcifications of the anterior longitudinal ligament and 4 loss of normal lordotic curve Osteophyte formation narrowing of the intervertebral joint space osteosclerosis and osteoporosis are common after age 40 Such x ray findings should not be interpreted as necessarily abnormal or responsible for clinical symptoms

► [It is unfortunate that this review covers only 102 patients with asymptomatic cervical spines. However, it does point up the fact that many abnormal findings occur particularly the narrowing of interspaces between the 5th and 6th cervical vertebrae that can occur without symptoms. This is important particularly from the medicolegal standpoint Were the study based on 1 000 or more patients of different age groups the findings might be statistically more valuable —Ed]

Fallacy of Term 'Whiplash Injury is pointed out by Paul W Braunstein and John O Moore[7] (Cornell Univ)

(6) New York J Med 58 3300-3303 Oct. 15 1958.
(7) Am. J Surg 97 522 529 April, 1959

There is an apparent risk pattern associated with the location of the occupant and a definite association of lash phenomena with rear end automobile collisions Do great attention given this syndrome in current medica legal publications the incidence of all cervical injury is s and the incidence of whiplash injury is by definition smaller From 5,710 automobile accidents in which inj occurred 144 cases of cervical injury were recorded in wh a whiplash phenomenon was experienced at the time of cident impact That is in this largest recorded accident e perience less than 1% of persons injured experienced whiplash phenomenon and had complaints or documente findings after the accident Among these 144 persons only 20% were definitely known to have received a dangerous or fatal injury the rest were known to have received no serious neck injury Therefore even fewer persons (about 0.3% of all injured) sustain any serious injury to the neck as a result of the whiplash phenomenon

Of the patients in this series with no diagnosis other than whiplash injury over two-thirds bore no serious injury to ny other body area Yet in the patients with a definite diag- osis such as fracture sprain or strain well over half had a existing serious injury to another body area From these ta it may be surmised that some patients situated in the involved in a classic rear-end collision though sustain- no serious injury find the environmental term whip- lash" convenient in subsequent litigation.

The term whiplash injury is a poor one Whiplash means only that the head and neck are subjected to a series of motions during and after accident impact. The term in no way describes a clinical anatomic or pathologic entity Because of the increasing frequency of litigation resulting from accident configurations causing a whiplash action of the head and neck the conscious or unconscious desire for gain might be present in the patient and in many cases is not removed by the examining physician or consulting lawyer

► [I agree wholeheartedly with the authors that the term "whiplash injury" is indeed an unfortunate one which merely implies the nature in which the injury or "alleged" injury occurred It would be much better if we could make the diagnosis on more specific clinical, anatomic or pathologic grounds Certainly methods of investigating the injuries of the cervical spine need to be improved so that accurate pathologic diagnoses may be made.—Ed.]

Clinicopathologic Correlations in Cervical Spondylosis. G Robert Nugent[8] (Duke Univ) points out that several different but interrelated factors are involved in the pathogenesis of cervical spondylosis some of which are secondary to the osteophytosis and some of which are unrelated. Whether symptoms arise from the degenerative process of the cervical vertebrae and intervertebral disks depends on the width of the sagittal diameter of the cervical spinal canal,



Fig. 154—Lateral view of cervical myelogram showing defects of posterior aspect of spinal canal opposite 3d 5th cervical interspaces (Courtesy of Nugent G. R. Neurology 9 273-281 April, 1959)

the physical size of the attachment of the denticulate ligaments and the presence of root sleeve fibrosis intradural adhesions and associated vascular insufficiency of the cervical spinal cord

The importance of the ligamenta flava in compounding the disorder of the spinal canal became apparent on study of a cervical myelogram of an elderly man who had myelopathy of undetermined etiology The only abnormality was in

(8) Neurology 9 273-281 April, 1959

the lateral view (Fig 154) which showed fairly deep indentations at the posterior aspect of the spinal canal opposite the 3d 5th cervical interspaces The neck was in moderate hyperextension and the indentations seemed to be due infolding of the ligamenta flava This encroachment on the mid cervical cord by infolding of the ligamenta flava was first observed by Taylor who studied myelograms of normal cadavers with the neck in hyperextension

In patients with cervical spondylosis the posterior defect caused by infolding of the ligamenta flava is often particularly prominent at the site opposite the osteophytic spur at the anterior aspect of the spinal canal and the total anteroposterior diameter of the canal may be severely compromised Obviously the effect of such space taking lesions in producing symptoms would be greatly enhanced by a cervical spinal canal with an unusually narrow sagittal diameter In unexplained cases of cervical cord disease the lateral view in extension should be added to the myelographic examination However the neck should not be markedly hyperextended during examination or the cord may be damaged further

The usual explanation for traumatic cervical cord injury in the absence of an acute ruptured disk bony dislocation or fracture is sudden dislocation of the vertebrae with immediate spontaneous realignment. Infolding of the ligamenta flava during hyperextension offers a better explanation for this type of injury The hazards of injury are much greater when pre-existing spondylosis is accompanied by vascular and connective tissue changes and perhaps by an unusually narrow spinal canal

If the ligamenta flava are as important in cervical spondylosis as implicated laminectomy with removal of these ligaments would seem to be adequate treatment in some cases This may be true in instances in which on opening of the dura and arachnoid no evidence of anticipated cord compression is found and tension on the denticulate ligaments is not impressive

Degenerative Changes in Cervical Spine Z B Friedenberg Jack Edeiken H Newton Spencer and S C Tolentino[9] (Univ of Pennsylvania) studied 41 cervical spines

(9) J Bone & Joint Surg. 41 A 61 70, January 1959

(average age 68 years) by anatomic dissection and roentgenography Gross disk changes between the 5th and 6th and the 6th and 7th cervical vertebrae were noted in 49% each (table) Disk protrusions accompanied by varying amounts of reactive bone formation but no frank disk herniations were observed Degenerative changes were present in most persons reaching the 6th decade Profoundly involved intervertebral spaces showed a characteristic pattern of pathologic changes which involved the entire disk space Prominent in this reaction were circumferential reactive bone changes at the margins of the bodies which abutted the involved disk space These changes also involved the area of Luschka s joints laterally but the apophysial joints often escaped involvement.

Disk Degeneration in 41 Specimens

2d-3d Cervical	4 (10%)
3d-4th Cervical	11 (27%)
4th 5th Cervical	17 (41%)
5th-6th Cervical	20 (49%)
6th 7th Cervical	20 (49%)
7th Cervical 1st thoracic	4 (12%)

In 135 paired vertebrae from 27 specimens examination was carried out after all soft tissue was removed by heating in an alkaline solution A correlation existed between disk degeneration previously noted and bone degeneration on the surface of the body in contact with the disk in 100 joints (74%) In 27 joints (20%) bone changes were seen without disk degeneration whereas in 8 (6%) changes were seen in the disk without bone changes

Posterior projecting osteophytes large enough to narrow the anteroposterior diameter of the spinal canal significantly were found on 9 vertebrae. In 5 of these the projection was on the 5th and 6th cervical vertebrae These posterior spurs would appear to be key factors in the production of symptoms.

When reactive bone changes on the lateral margins of the inferior surfaces of the vertebral bodies in the region of Luschka s joints were extensive they encroached on the foramens of the vertebral vessels The possibility of reduced blood flow or arterial spasm in the vertebral artery as a result of these bone changes should be considered

Among 41 specimens with films in the anteroposterior lateral and oblique projections that were dissected later a

correlation between x ray and anatomic manifestations of disk degeneration was found in 67% Narrowing of the intervertebral space was the most common x ray finding Even minor narrowing was indicative of disk degeneration Anterior lipping of the body was present in 25% of the vertebrae examined A concavity on the surface of the spur contiguous to the interspace often revealed anterior disk protrusion Posterior spurs were most easily seen in oblique films and were always associated with a narrow disk space. Of 64 interspaces showing changes in the lateral joints on dissection 53 (83%) showed x ray changes X ray examination of the apophysial joints is difficult but changes were best seen in the lateral view In only 12 of 37 joints with anatomic changes were the changes diagnosed by roentgenograms

Iatrogenic Stiff Shoulders were studied by Robert G Thompson and Edward L. Compere.[1] A number of surgeons who treat trauma to the upper extremity immobilize the patient s arm in a sling Velpeau dressing shoulder spica, hanging cast or some other type of fixation To obtain adequate healing of hand injuries or forearm or elbow fractures immobilization is required of the affected areas However, too often the entire arm and shoulder are immobilized for 6-8 weeks or longer Many patients with a completely healed Colles fracture return to the treating physician complaining of pain and stiffness in the shoulder They are unable to raise the arm above shoulder level

Patients will not make what may appear to them to be unnecessary movements They will not exercise the shoulder joints unless specifically instructed to do so by the physician Any patient who has a fracture involving the fingers hand forearm or elbow that is immobilized in a short or long arm case with or without a sling should be specifically told on repeated occasions that the arm must be raised above the head several times a day If this simple procedure is carried out much future distress and disability can be prevented

As orthopedic consultants to the Liberty Mutual Rehabilitation Center Chicago the authors were impressed by the number of patients with stiff shoulders who needed treatment after an injury to the hand or arm had healed A survey of 130 patients with arm or hand injuries admitted from

(1) J.A.M.A. 169:945-946 Feb. 28, 1959

January, 1957, to January 1958 revealed 11 had no known injury to the shoulder but had less than normal motion of the shoulder of the arm that had been treated. None recalled that the treating physician specifically instructed them to move the arm at the shoulder through a full range of motion several times each day during the immobilization period.

► [I agree with the authors that all too frequently we see the development of a stiff shoulder following treatment of Colles fractures and other conditions which require immobilizing the patient's arm in a sling a Velpeau dressing etc. Certainly we can help the patient and lessen his period of disability only if we as physicians specifically instruct him regarding re establishing shoulder motion at the time the forearm or arm is immobilized. Too often the Colles fracture or forearm injury heals only to have the physician confronted with the problem of a stiff shoulder and a long period of disability and treatment as far as the patient is concerned.—Ed.]

Periarthritis of Shoulder Study of the Disease and Its Treatment is presented by G C Lloyd Roberts and P R. French[2] (St. George's Hosp London) Periarthritis or capsulitis of the shoulder is characterized by severe pain and progressive limitation of movement of unknown cause. Usually the symptoms increasingly dominate the patient's activities and interfere with sleep for many months The pain

TABLE 1—Number of Patients Recovered 3 and 6 Months after Treatment

Treatment Group	Patients	Well at 3 Mos.	Well at 6 Mos.
Hydrocortisone	19	11 (58%)	15 (79%)
Cortisone	13	2 (15%)	6 (46%)
Control	27	8 (29%)	14 (52%)

and spasm gradually abate and the shoulder becomes stiff (frozen shoulder) Recovery of movement usually is slow until full function is regained with a normal range of movement or the limitation of movement is so trivial that there is no functional disability

Periarthritis of the shoulder of standard minimum severity and duration was diagnosed by these criteria in 59 patients pain in the shoulder which was present for at least 3 months inability to lie on the affected shoulder and loss of at least one half of the normal range of external rotation as measured with the arm at the side forearm in supination and elbow flexed to 90 degrees Results of treatment by physical methods sometimes followed by late manipulation under anesthesia by physical methods combined with oral cortisone and by physical methods with early manipulation

(2) Brit M. J 1 1569-1571 June 20 1959

under anesthesia after injection of hydrocortisone 25 mg into the shoulder were compounded

In analyzing treatment results, these factors were considered the anticipated duration of the illness when steroids were not used the influence of sex and age on the natural history of the disease, and duration of the symptoms when treatment began and its effects in relation to this factor and the natural history of the disease

Results favored treatment with hydrocortisone (Table 1)

TABLE 2—Number of Patients Recovered 1 Year from Beginning of Symptoms

Treatment Group	Patients	Well 1 Year from Onset
Hydrocortisone	19	13 (68%)
Cortisone	13	7 (54%)
Control	27	12 (44%)

TABLE 3—Treatment Results in Patients Whose Symptoms Lasted Over 3 Months, but Less Than 6 Months —Reviewed 3 Months Later

Treatment Group	Patients	Well in 3 Months
Hydrocortisone	11	9 (82%)
Cortisone	12	2 (17%)
Control	16	5 (31%)

but the difference was less convincing when both groups were compared 1 year from onset of symptoms regardless of the time at which treatment began after the initial 3 months waiting period (Table 2) However results in patients treated between 3 and 6 months from onset of symptoms strongly favored the hydrocortisone series (Table 3)

► [It is my opinion that periarthritis or capsulitis of the shoulder is a greatly misunderstood condition as far as its treatment is concerned. Rather than depending on injections and systemic medications for relief of pain, the most important item in treatment is to restore motion to the shoulder joint. This can be accomplished sometimes by the use of stretching exercises and ordinary physical therapy measures, but when the patient does not progress under these simpler measures then manipulation under anesthesia is to be recommended, followed by the resumption of physical therapy. At times, several manipulations may be necessary. I do not believe that hydrocortisone injection is of value in itself, but it can be used in conjunction with manipulation and physical therapy. Until the motion is restored, the shoulder will remain limited and as long as it remains limited in its motion it will be painful.—Ed]

Cervical Sympathetic Blocks in Treatment of Brachialgia were used by Anders Lidström[3] The brachialgia syndrome presents a varying picture as to type localization severity and duration of symptoms The outstanding symptom in all patients and sometimes the only one to present itself

(3) Acta orthop scandinav 28 300-305 1959

is pain centered in the shoulder girdle and its vicinity The clinical course may vary from the occasional quickly subsiding attack to more or less regularly recurring painful periods and finally to a chronic painful condition that may totally disable the patient for years Severity and type of pain also are not reliable criteria for accurate prognosis.

The author thought that by treatment directed at the cervical sympathetics notably their central "switchboard the stellate ganglion it may be possible to disrupt the transmission of painful stimuli along the autonomic pathways or to reduce the excessive irritability that may conceivably be present. Lidstrom used cervical sympathetic blocks in 60 patients with persistent symptoms of several years duration.

Technic.—Injections were made partly by the medial approach with the needle inserted immediately laterally to the trachea, but medially to the vessels and partly by lateral approach, with the injection site behind the lateral aspect of the sternocleidomastoid muscle and the needle directed diagonally medially and dorsally Injection was made 2 fingerbreadths over the clavicle. The needle-point was then retracted some millimeters and the site aspirated to ascertain that the needle had not penetrated into a vessel or into the subarachnoid space After that, 10-15 cc. of 1% Xylocaine-epinephrine solution was injected. Only if a complete Horner syndrome appeared within a few minutes of the injection was the treatment regarded as technically satisfactory

Results were more favorable among patients in whom the condition had been present for a somewhat shorter time Temporary relief after the injection with pain recurring within a few days was recorded in 16 patients Thus brachialgic pain could be relieved temporarily or more lastingly by a cervical block in 70% of the study patients

The cervical sympathetic block is a technically simple and safe method of treatment effective to a sufficiently great extent to be considered a valuable alternative in treatment of painful conditions of the shoulder girdle and arm

Bicipital Tenosynovitis According to Kenneth F Spence Jr[4] (Nat'l Naval Med Center) the basic cause of bicipital tenosynovitis encountered among patients in the 2d and 3d decades is some congenital abnormality in the bicipital sulcus or groove such as a supratubercular ridge or pronounced obliquity of the medial wall of the intertubercular sulcus that favors subluxation or even dislocation of the tendon out of the bicipital groove Generally the syndrome

(4) M Ann. District of Columbia 28 386-387 July 1959

is initiated by insidious onset though at times it is precipitated by strenuous activity Initially the pain is localized over the anterior and medial aspect of the shoulder The pain may radiate to the body of the biceps muscle to the flexor surface of the forearm to the insertion of the deltoid muscle to the inferior angle of the scapula and even to the base of the neck The pain may be relieved by rest and aggravated by activity at first but later it usually becomes more or less constant. The usual physical finding is exquisite tenderness over the intertubercular sulcus and on palpation of the biceps tendon The clinical course in young persons is characterized by recurrent pain rarely of sufficient severity to cause serious dysfunction Only occasionally does the disorder become protracted Among patients in the 3d decade and older, though the symptoms and physical findings may be as described the course of the disorder is often more protracted and more severe It is probably due to degenerative changes in the tendon together with the formation of bony excrescences in the bicipital groove

Essentially treatment is conservative Application of local heat preferably moist heat rest of the part and restriction of motion within painless arcs together with injection of Xylocaine and hydrocortisone (directly into the tendon sheath under the transverse humeral ligament) will relieve pain and terminate the syndrome in most instances Usually 3 or 4 injections at weekly intervals will produce the desired results Surgery may be indicated after an adequate trial of conservative therapy has proved unsuccessful

Spence reviewed the records on 12 males and 3 females who had a bicipital tendon transfer operation because of bicipital tenosynovitis All had pain localized over the anterior aspect of the shoulder and tenderness to palpation of the biceps tendon in the bicipital groove All had received trials of conservative therapy At operation some abnormality was found about the biceps tendon in all which varied from chronic inflammation adhesions and scarring of the tissues to thickening and edema of the tendon sheath Of the 15 patients 11 stated that the symptoms were relieved

Voluntary Bilateral Posterior Dislocation of Shoulder Joint. Gershon Gitlin Armin Schwartz and Amos Welner[3] (Jerusalem) report a case

(3) Am J Surg 97 777 781 June 1959

Man 22 had been able to dislocate his shoulders voluntarily as long as he could remember Dislocation could be produced easily rapidly and painlessly with the arm hanging by the side (right or left shoulder) with the arm held vertically (right side only) in 90 degrees or

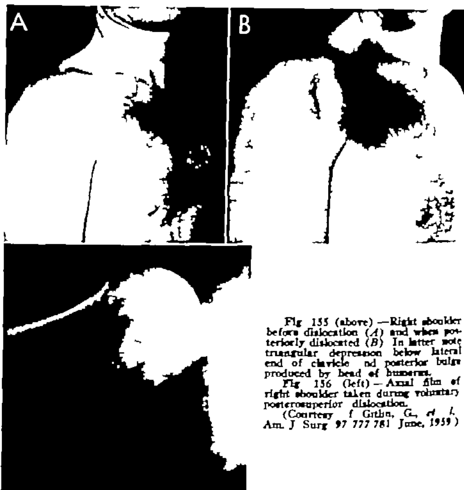


Fig 155 (above) —Right shoulder before dislocation (*A*) and when posteriorly dislocated (*B*) In latter note triangular depression below lateral end of clavicle nd posterior bulge produced by head of humerus.

Fig 156 (left) —Axial film of right shoulder taken during voluntary posterosuperior dislocation.

(Courtesy f Gribn, G., *et l*, Am. J Surg 97 777 781 June, 1959)

less of flexion (left side more difficult than right) in 90 degrees or less of abduction (right side only) or adducted across the chest wall (right side only) Whenever dislocation could be achieved, reduction could also be carried out at will. In all instances the dislocation was posterior

Inspection of both shoulders with the patient at rest revealed no abnormalities except that they possessed a greater than normal range of movement. Inspection of the dislocated shoulder showed a triangular depression below the end of the clavicle and a posterior bulge produced by the head of the humerus (Fig 155) Through the anterior depression the anterior margin of the glenoid cavity could be palpated

Posterior dislocation could be achieved passively by pressing firmly on the anterior aspect of the humeral head, provided the muscles were

completely relaxed. Immediately after pressure on the humeral head was released the dislocation reduced itself spontaneously. Passive dislocation could not be produced if the patient resisted.

There was hypermobility in the joints of the patient's vertebral column, the elbows fingers and thumbs and the hips. Over the dorsal aspect of the elbows folds of skin larger than normal could be drawn out, but elsewhere there was no evidence of excessive elasticity of the skin

Roentgenograms in this case brought out two points of interest (1) There was no tendency for the humeral head to be drawn into the infraspinous fossa (Fig 156) in traumatic dislocations this tendency is often present (2) The true articular space was clearly seen when the joints were voluntarily dislocated This space can often be demonstrated in infants and children in the normal shoulder and in other joints and sometimes in the shoulder of adults The true joint space apparently has not been demonstrated previously in a case of posterior dislocation of the shoulder

In purely voluntary dislocation of the shoulder the patient must be able to contract the muscles which produce the dislocation without simultaneously contracting their antagonists There must also be increased elasticity of the joint capsule and its ligaments This is not simply a laxity which would make for instability of the joint whereas in voluntary dislocation the joint is completely stable. The increased range of movement seen in many of this patient's joints and the increased elasticity of the skin in the elbow region raise the possibility of some connection between cases of purely voluntary dislocation and the Ehlers Danlos syndrome.

[Although voluntary dislocation of the shoulder joint is rare, I have had the opportunity to see such a situation in a young patient. There was much discussion about whether anything could be done by surgical means to prevent this, but the opinion of various consultants was that she should be cautioned against dislocating her shoulder and see how she would develop as time progressed. It might be that putting this patient on a series of "bowling exercises" would be of value in developing the muscles of the musculotendinous cuff and by their development help to prevent the dislocation Before any of these patients are actively treated, it is necessary to find out just how and by what muscle contracture they are able to perform this voluntary dislocation. Needless to say, it is an interesting phenomenon and fortunately observed with relative infrequency—Ed.]

► Pulled Elbow Rodney Sweetnam[16] (Royal Nat'l Orthopedic Hosp London) points out that subluxation of the radial head a painful condition of acute onset in children has received little attention in medical writings. Pulled elbow is

(16) Practitioner 182 487-489 April, 1959

probably the commonest name given the condition although traumatic subluxation of the radial head would be more correct. Other terms are 'sprung elbow' and 'nursemaid's elbow' By a simple manipulation of the elbow without anesthesia a dramatic cure is instantly obtained (Figs 157 and

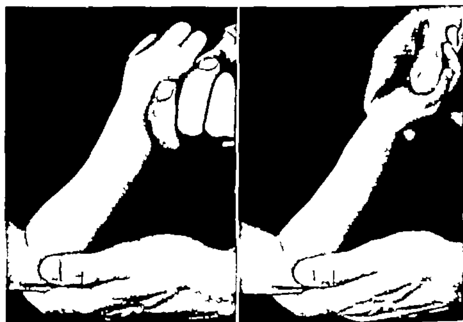


Fig 157 (left) —Position at start of supination manipulation of pulled elbow
Fig 158 (right) —Completed manipulation.
(Courtesy of Sweetnam, R Practitioner 182 487-489 April, 1959)

158) Without treatment pain continues for a variable period often as long as 3 days Spontaneous recovery however is the rule and explains why the condition is so often unrecognized a bad sprain being diagnosed instead

A characteristic history is that of a child who suddenly tripped while walking along the pavement holding her mother's hand The mother in an effort to prevent the child from falling jerked her upright by the arm At once the child started to cry the arm lying limply by her side attempts to move the elbow were obviously painful

The history of a jerking longitudinal pull on the outstretched arm should at once suggest a pulled elbow The mechanism of injury is unlike that which produces a supracondylar fracture such as follows an awkward fall on the arm Physical examination rules out more serious injury although in cases of doubt an x ray should be taken The

limp arm may suggest a brachial plexus injury but the site of pain and normal sensation with protective muscle spasm should exclude this diagnosis

► [The condition of the "pulled elbow" is often missed in the emergency room. Too often, the child suffers unnecessary pain, disability and a fretful night until he can be seen by someone who recognizes the condition. Truly it is a subluxated radial head but with an essentially normal x ray picture A child who has suffered this kind of injury and is presented with a pronated painful elbow should be suspected of having a subluxated radial head, and treatment instituted whether or not an x ray shows anything abnormal. If the arm cannot be manipulated without anesthesia, a very short anesthesia will suffice. The relief of pain and restoration of motion of the arm is dramatic. I keep the elbow immobilized in a posterior plaster splint with the elbow flexed 90 degrees and the forearm supinated for about 10 days before allowing resumption of activity.—Ed.]

Treatment of Tennis Elbow (Epicondylitis) by Denervation. Although the actual pathologic mechanism of epicondylitis is not known it is suspected that the pain and weakness are associated with the complex nerve distribution of the region and might be due to some irritant factor affecting these nerves Emanuel B Kaplan[7] (Columbia Univ) treated 3 patients with epicondylitis by denervation of the epicondylar region Relief from pain was immediate and there have been no recurrences

TECHNIC.—A curved incision is made on the anterior surface of the elbow parallel to the medial contour of the brachioradialis muscle (Fig 159) The antebrachial fascia is incised parallel and lateral to the musculocutaneous nerve Retraction of the fascia exposes the groove between the brachioradialis and biceps muscles Gentle blunt separation of the fatty tissue in the groove permits exposure of the radial nerve and its branches These are exposed throughout the length of the incision by retraction of the brachioradialis muscle laterally and the biceps tendon and muscle together with the musculocutaneous nerve medially Usually the muscle branches of the radial nerve emerge from the main trunk on the lateral side and the articular branches on the medial side in the supracondylar region It is easy to follow the branches to the epicondyle and humeroradial joint. After the articular branches are definitely identified they are excised the muscles and nerves are allowed to fall into their normal relation, and the skin is closed.

As a preliminary test for effectiveness of denervation the periosteal and articular branches of the radial nerve are blocked with 1% procaine If the injection is followed by immediate relief from pain and ability to extend the thumb and wrist without discomfort operation may be expected to be beneficial The needle for injection of procaine is intro-

[7] J Bone & Joint Surg. 41 A 147 151 January 1959

eral to the olecranon process of the ulna. A no. 20 needle is inserted just lateral to the olecranon and just distal to the lateral epicondyle of the humerus. A solution of chloroprocaine (Nesacaine) 1% is introduced into the periosteum before injection of the prednisolone. This maneuver is preceded by a skin wheal then the deeper tissues are infiltrated with chloroprocaine 1% The needle is left at the injection site and the contents of another syringe, of 1 1.5 cc. prednisolone, is injected into the site.

Usually after the initial injection of chloroprocaine and prednisolone the reaction was severe and extremely pronounced On the evening after the injection codeine was needed for pain relief If at the end of 1 week the patient still had symptoms or objective findings the injections were repeated If no relief was obtained after the fourth injection the treatment was abandoned Initial injection of chloroprocaine is important to relieve pain and therefore it is given at the exact site of pathology

After one injection results were excellent in 215 patients and fair in 40 after 2 or more injections results were excellent in 90 and fair in 15 Unimproved after the first injection were 25 after 2 or more injections 6 Symptoms disappeared on the average in about 8-10 days There were no untoward results or evidence of extreme allergy A few patients became lightheaded and dizzy and it was recommended that the injections be carried out with the patient dorsorecumbent.

► [In our experience, the use of hydrocortisone and similar preparations for treatment of tennis elbow has yielded fairly satisfactory results. In some instances, the pain is immediately relieved and in a few instances the condition permanently cured. However in a great many instances several injections are needed and often the patient will say he gained relief from pain for about 4 weeks only to have the pain resume again. Occasionally the injection treatment meets with complete failure and it is then that operative methods need to be undertaken if the pain is severe enough to be disabling I have had no experience with the treatment of this condition by denervation as outlined in a previous paper by Kaplan, page 287—Ed.]

Elbow Fracture and Late Ulnar Paralysis E. T J A Van Thiel[1] points out that one of the commonest causes of late ulnar paralysis is cubitus valgus after a previous elbow fracture. The cubitus valgus deformity develops as follows the physiologic pressure is of great importance for the growth and harmonious development of the bone. During development of the elbow joint, normal longitudinal growth is subject to physiologic inhibition caused by pressure exerted by adjacent osseous parts of the joint. If in the growing subject, a fracture of the lateral condyle of the humerus is insuffi

(1) Arch. chir neerl. 11 151 164 1959

ciently repositioned or if a fragment is removed the pressure exerted by the humerus on the radius is removed on the lateral side whereas the medial part of the elbow will continue to grow in normal manner or sometimes even at an increased rate.

The same phenomenon occurs if the capitulum is removed in the case of fracture of the radial capitulum In such event, the radius tends to displace itself in proximal direction and may become longer than normal because physiologic inhibition of growth by pressure from the humerus is lacking The radial length may also remain subnormal because of a disturbance in epiphysial longitudinal growth

Surgical treatment is indicated in late ulnar paralysis associated with cubitus valgus because spontaneous recovery cannot be expected. Restoration of ulnar function after transposition mainly depends on two factors reversibility of pathologic changes in the nerve affected and reversibility of pathologic changes in the motor and sensory end organs and muscles Secondary irreversible fibrous changes have been found to occur if muscular tissue is deprived of its innervation for longer than 18 months

Optimal reposition of fractures of the lateral (epi) condyle of the humerus and neck of the radial head is of importance in children—in whom physiologic longitudinal bone growth is not yet completed—lest a disturbance in growth result Epiphysial closures of the joint can be evaluated on the basis of x ray findings Fractures with dislocation with the fracture line in the immediate vicinity of or extending into the epiphysis should be treated carefully Only in exceptional cases should removal of loose fracture fragments be carried out in young children. Watson Jones advocates that the loose fragment in a lateral condyle fracture with dislocation can be sutured even after 2 years The fracture surfaces are then refreshed and the fragment is fixed in its position by catgut sutures In fractures of the radial head and condyle conservative treatment should be abandoned in favor of early surgical reposition It is useful in patients in whom a previous fracture has resulted in a progressive valgus position of the elbow joint to institute prolonged supervision in cooperation with the neurologist to insure that ulnar transposition can be (prophylactically) performed in time if necessary

Avulsion of Distal Tendon of Biceps Brachii from Radial Tuberosity is uncommon but not rare. Two cases are reported by W J J Thomas[2] (Chamber of Mines Hosp., Johannesburg)

Man 49 slipped while walking in a mine. To prevent a fall, he threw his right arm around a supporting prop at the same time flexing his elbow forcibly He experienced cramplike pain in his right biceps muscle, which was retracted toward his shoulder Examination the next morning revealed ecchymosis on the medial aspect of the lower right arm and upper forearm There was tenderness in the antecubital region. The belly of the biceps was bunched into the proximal half of the arm. The biceps tendon was not present in the antecubital region and the brachialis could be more easily palpated. The power of flexion and supination of the elbow was diminished.

At operation Henry s approach to the tuberosity of the radius was used The distal biceps tendon was found lying free on the underlying brachialis muscle. A hiatus was found where the tendon had pulled out and a director was passed through this down to the radial tuberosity After a small portion of the supinator muscle had been reflected and with the forearm in full supination the tuberosity was well exposed. The bare area from which the avulsion had occurred was free from ridging or flaking Two drill holes were made transversely through the tuberosity its surface was roughened slightly and the biceps tendon was sutured into position with braided wire.

The elbow was immobilized in almost full flexion and supination for 3 weeks then at a right angle for 2 weeks more, after which exercises were instituted. The patient resumed work 10 weeks after operation. Four months later flexion was full but extension was limited by 20 degrees. Supination was full and powerful, but pronation was limited by 30 degrees.

The symptoms and signs in avulsion of the distal tendon of the biceps from the radial tuberosity are so characteristic that diagnosis presents no difficulty If surgical repair of the lesion is contraindicated by the patient s age or for other reason the functional disability in the elbow is not great. If operation is undertaken Thomas advises reattachment of the tendon to the tuberosity of the radius rather than suture of the tendon to the brachialis tendon. There has been a tendency to place too much stress on the risks involved in surgical exposure of the tuberosity If Henry's approach is used, the operation offers no particular technical difficulties.

Wringer Injuries of Upper Extremity Clinical Pathologic and Experimental Study is presented by John P Adams and Francis D Fowler[3] (Washington D C) A

(2) South African M J 32 1040-1042, Oct. 25 1958.
(3) South M. J 52 798-804 July 1959

wringer injury may be defined as a crushing injury to the upper extremity incurred as the arm passes through the rollers of the wringer of an electric washing machine The authors reviewed data on 137 patients with such an injury Adequate follow up study was available on 120 All received similar care The patients were divided into two groups those seen early and those seen late. Any patient seen within 24 hours of the injury was considered as seen early Early care was given to 111 patients whereas 9 received late care, 28 hours to 4 days after the injury

The most prominent presenting physical finding in 108 patients was edema of the extremity which varied from mild swelling to moderate pitting edema. Abrasions of the severity of 2d degree burns were noted in 22 patients Fifteen had lacerations when first examined Seven children and adults had partial avulsions of full thickness skin flaps. An unusual finding in 1 adult was lateral subluxation of the extensor tendon to the 3d finger Two patients had large blisters in 1, involving the dorsum of the wrist and in the other involving the upper third of the volar surface of the forearm Two patients gave only a history of a wringer injury and were without positive physical findings

The commonest location of a roller burn was at the elbow There were 15 lacerations Ten involved the web spaces Five fractures occurred in 4 patients and did not influence the course or outcome of the soft tissue injury

All were hospitalized. The extremity was washed with surgical soap and sterile water Lacerations when present were sutured. A compression dressing consisting of three layers of sheet wadding and elastic bandage was applied. The compression dressing extended from the finger tips to the axilla, the fingers being wrapped individually The extremity was suspended for 72 hours. The dressings were then removed and the extremity re-evaluated X rays were taken to determine possible bone injury The extremity was rewrapped Patients with satisfactory course were usually discharged on the 5th hospital day

A normally functioning extremity was obtained in 116 of the 120 patients followed

The Severed Flexor Tendon According to J William Littler[4] (Roosevelt Hosp New York) a tendon repair within the proximal two thirds of the fibrous sheath limited by the midpalmar and proximal interphalangeal skin creases often fails to restore flexor function Both sublimis and profundus tendons are generally divided when the injury falls within

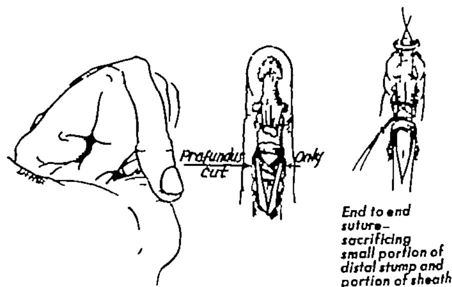


Fig 160—Primary repair is indicated when profundus tendon is severed near its insertion and sublimis tendon is intact. At least terminal phalanx can be stabilized and finger power preserved. Sensory nerves can be repaired at this level, but with some difficulty because of decreased caliber If pulp is without sensation, necrosis may be produced by compression of pull-out suture. This is prevented when traction wire is passed through nail. (Courtesy of Littler J W S Clin. North America 39 435-447 April, 1959)

this region. There the two tendons (in reality three, because of the sublimis bifurcation) are intimately ensheathed by the synovial lined metacarpophalangeal fibro-osseous tunnel which prevents bowstringing at a point where amplitude is greatest. However good results can be obtained primarily with the terminal phalangeal flexor (profundus) when the juncture of the severed tendon lies within the palm wrist or near its insertion A primary repair made in the soft tissue of the palm proximal to the fibro-osseous tunnel is facilitated when the tendon has been severed with the finger in exten

(4) S. Clin. North America 39 435 447 April, 1959

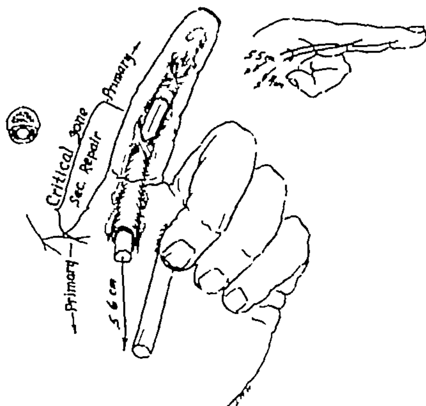


Fig. 161.—Flexor tendon amplitude indicating increment from insertion to midpalm. Full range of proximal interphalangeal joint is most important functional consideration of finger Sublimis, if intact, should never be sacrificed for reconstruction of divided profundus tendon. If both tendons have been divided, terminal phalangeal flexor takes precedence because it acts as secondary proximal interphalangeal flexor in grasp, if not in pinch. Because full amplitude is needed at digit base to flex interphalangeal joints, tendons divided at this level are best restored through secondary free graft. (Courtesy of Littler J W : S. Clin. North America 39 435-447 April, 1959)

sion. Conversely primary repair of the profundus tendon severed in the finger distal to an intact sublimis tendon is favored by an injury in flexion (Fig 160)

In addition to the 4 or 6 cm. of amplitude at the level of the midpalm required in adults to flex the phalanges (Fig 161) the two tendons have also a differential glide of about 1 cm adherence of the two negate full active flexion of the distal interphalangeal joint. The complexity of this dual tendon function within the proximal digital sheath is for the most part beyond surgical restoration and with both tendons severed despite the importance of the sublimis for thumb and finger pinch any attempt at repair should be directed toward the profundus alone. The best that can be done when both tendons are severed in the region of the proximal phalanx is

to substitute a single tendon graft for the profundus from the level of the lumbrical origin to the terminal phalanx. Here at least there is an intact tendon through the area of injury with its proximal gliding juncture in the soft tissue of the

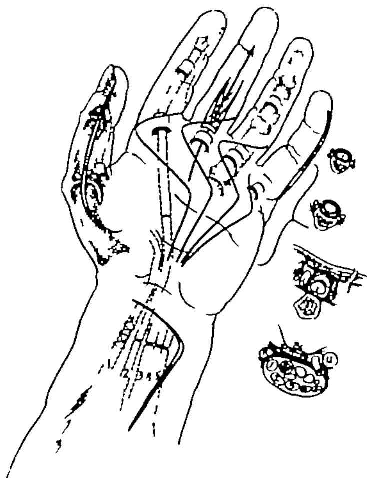


Fig 162.—Elective incisions for exposing flexor tendons of wrist, palm and digits. Optimum sites for junctures indicated by break in tendon continuity. Serial cross-sections show relation of nerves and tendons to retinacular system. Relation of essential pulley mechanism to proximal and middle phalanges shown, especially in ring finger. When small caliber free tendon graft is used to restore profundus tendon in presence of intact sublimis, graft must be passed from its profundus juncture in palm through hiatus in sublimis tendon (arrow). Flexor pollicis longus and profundus tendons are numbered and divided into independent terminal phalangeal flexors of (1) thumb and (2) index and common flexors of middle, ring and little fingers. (Courtesy of Littler J W S Clin. North America 39 435-447 April, 1959)

palm and its distal one at the insertion where amplitude is negligible (Fig 162) This secondary procedure demands exacting technic but the results in properly selected and executed cases are gratifying When only the profundus is severed the intact sublimis tendon should rarely if ever be

sacrificed A good result can now be obtained by substituting a slender tendon graft for a divided profundus with preservation of the sublimis (Fig 162)

Injuries to Flexor Tendons of the Hand in Children John L Bell Michael L. Mason, Sumner L Koch and William B Stromberg Jr[5] (Chicago) treated 60 children, aged 1 10 who had hand injuries Injuries to nerves and tendons were caused by glass in 38 patients, metal knives or razors in 12 tearing lacerations (power saws hedge cutters escalators) in 7 and crushes (escalators, bricks) in 3 Primary repair of divided flexor structures was done in 5 patients and in 56 secondary reconstructive procedures

Preoperative diagnosis of tendon injuries in the child too young to cooperate was not difficult provided careful observations of the hand posture were interpreted properly In the young child nerve injuries could be suspected by the location of the surface wound However absolute identity of nerve interruption had to be confirmed at operation

Secondary operative procedures included tendon grafts within the flexor sheaths of the fingers and thumb and repairs of multiple nerve and tendon injuries in the palm Though the structures are smaller in the child s hands the operative procedure was often less difficult than in the adult hand. In most patients the interphalangeal joints were supple and scarring was less than in older patients Usually the long extensor tendon of a toe was used for grafting

Postoperatively the child s hand was flexed at the wrist and the digits were moderately flexed. Position was maintained for 21 25 days by use of a compression dressing and an aluminum splint In children under age 6 plaster molds or casts that extended above the elbow were used to help maintain the hand position during healing

In the young child suture removal was carried out under general anesthesia Active motion was permitted after the 21 25 days of immobilization. The parents were instructed to wash the child s hand for 10 minutes 3 times a day and to encourage the patient to use the hand without restriction Formal physical therapy was not prescribed

Follow up was continued at yearly intervals in many of the young children before the end result could be ascertained Primary profundus tendon repair within the digital

(5) J Bone & Joint Surg 40 A 1220 1230 December 1958

sheaths yielded 1 good result and 1 fair In 3 patients the interval after repair was too short to assess results, but satisfactory progress in the return of function was observed. In 48 patients with adequate follow up who had secondary repair results were excellent in 23 and good in 17 Of 28 patients with tendon grafting in the fingers, 12 had excellent results and 9 good Five excellent results and 2 good were obtained after insertion of long tendon grafts into the thumb Results after secondary repair of nerves and tendons of the palm were excellent in 6 patients good in 6 and fair in 1

► [We prefer the palmaris longus as the source of the tendon graft in the child as well as in the adult. Fine catgut sutures to close skin wounds which are mid lateral in the finger or in line with flexion creases obviate the need for a general anesthetic for removal of sutures—Paul R. Lipscomb.]

Free Tendon Grafting in Treatment of Flexor Tendon Lesions in Thumb and Fingers The conditions for suturing a tendon that is surrounded by paratenon are relatively favorable because a new layer of paratenon tissue will develop around the suture and allow return of free gliding movements Tendon sutures within sheaths, however result in firm adhesions to the surrounding tissues A J C Huffstadt[6] (Univ of Groningen) describes a method for repairing hand tendons severed within the sheath

TECHNIC.—Through a lateral incision, the entire skin is dissected from the ventral surface of the thumb or fingers. An incision along the distal palmar crease brings the tendons and lumbrical muscles into view Scar tissue is removed the pulleys being saved if possible. The sublimis tendon is cut in the palm. The profundus is cut distally about 0.5 cm. from the terminal phalanx and proximally in the origin of the lumbrical muscle. The tendon graft is obtained from the palmaris longus muscle or from one of the toe extensors.

In the fingers, the distal tendon suture is made first. The graft is pulled underneath pulleys and through any sheath remnants into the palm. The skin of the finger is sutured. The exact length of the graft is adjusted and the proximal end sutured. The finger should finally be in the same semiflexed position as its neighbors.

In the thumb a graft is used that reaches from a point midway in the thenar muscles to the distal phalanx. Another incision is made just proximal to the wrist through which the flexor tendon of the thumb is pulled. The proximal tendon suture is made first. The graft and flexor are pulled underneath the ventral wrist ligament, through the canal in the thenar and underneath the pulley at the base of the proximal phalanx. The length of the graft is estimated and the distal suture is made. A pressure dressing and immobilization in correct position with elastoplast completes the operation

(6) Arch. chir neerl. 10:305-317 1958.

Small movements as far as the dressing allows are begun after 10 days. The dressing and stitches are removed 3 weeks after operation and physiotherapy is started.

Of 55 tendon grafts performed using this method 41 gave good results (the finger tip could be brought actively within 1.5 cm of the palm) and 14 gave poor results The time between the accident and operation varied from 4 weeks to 5 years

► [In most patients, we have not found it necessary to elevate skin flaps with such acute angles depicted in this article, and it is preferable to work through several incisions which do not cross flexion creases. If a temporary suture is attached to the proximal end of the lacerated flexor pollicis longus tendon before it is withdrawn into the wrist wound, this can next be attached to the distal end of the graft and thereby aid in placing the graft in its correct location in the thenar eminence.—Paul R. Lipscomb]

Experimental Use of Teflon in Tendon Surgery Primary or secondary reconstruction of the flexor mechanism within the proximal segment of the fingers still gives disappointing functional results Adherence of the repaired tendon to surrounding tissue and to the snug proximal pulley too often results in pronounced restriction of flexion and extension of the finger Secondary reconstruction of the flexor mechanism by free full length tendon grafts with wide local resection of the proximal pulley may result in a functional range of motion but only occasionally does the reconstruction result in complete flexion and extension of the finger

As a result of previous experimental studies Richard I Gonzalez[7] (Stanford Univ) suggested the use of polyethylene as a blocking sheath between the healing tendon and surrounding structures Two disadvantages to use of this material around primarily repaired tendons are the healing time is greatly prolonged from the blockage of ingrowing blood vessels and considerable foreign body reaction is created by this material

In the present investigation Teflon (polytetrafluoroethylene) which previously had been reported as nonreactive by several investigators was used (in dogs) as a blocking agent about sacrificed tendons and also as a pulley substitute Visible reaction to the Teflon occurred in every instance in which it was used There was massive reaction in about 35% of the experiments. Gonzalez believes therefore that Teflon is unsatisfactory for use as a possible blocking mechanism or as a pulley substitute A pulley made of stainless

(7) Plast & Reconstruct. Surg. 23 535 539 May 1959

steel wire that was threaded through a polyethylene catheter gave by far the best results as a pulley substitute. However, it was inferior in all ways to pulleys made from free tendon grafts

Carpal Tunnel Syndrome is characterized according to Martin Singer[8] (Univ of Cape Town) by paresthesia, numbness and pain or ache in the median nerve distribution in the hand. However the most important clinical feature is the paroxysmal nocturnal nature of the attack. Singer studied 12 women and 1 man who had 19 carpal tunnel compressions All but 1 of these patients stated that the symptoms were far worse at night. The symptoms were usually aggravated by manual work performed during the day A feeling of swelling or bursting' in the affected fingers at night was noticed by 7 patients

Sensory signs may take the form of hypo- or hyperesthesia in one or more of the affected digits but rarely in all Generally the sensory signs when present are discouragingly vague. In 9 patients sensory changes were found Only 14 had signs of motor disturbance Three had slight wasting of the abductor pollicis brevis and 1 some weakness of the opponens pollicis. Tinel s test involves tapping and compressing the median nerve at the proximal border of the flexor retinaculum (anterior carpal ligament) with the examiner's index finger The test was negative in 7 of the 12 patients in whom it was attempted. When the test was positive the numbness or paresthesia was always felt by the patient in the middle finger In the flexion test, the patient s wrists are flexed actively to 90 degrees (palmar flexion) and this position is maintained for not less than 40 seconds In all 9 patients thus studied, the test was positive the patients had paresthesia or numbness in the middle finger and occasionally in adjacent fingers as well

Diagnosis is essentially established clinically Therefore the discovery of disk degeneration or irregularity of the foramens in the x rays should not influence the physician unduly because these features are commonly observed in middle aged patients who are free from symptoms

Complete division of the flexor retinaculum affords immediate and lasting relief from the distressing symptoms The division must be complete to obtain a successful result

(8) South African M J 33 415-419 May 16 1959

Decompression of 16 median nerves led to immediate permanent relief from symptoms In every instance the tendons were covered by an abnormally thick sheath of material the nature of which is not known

► [This syndrome is much more common than has been recognized The diagnosis should be made and treatment instituted before muscle weakness and atrophy occur Some patients who have early or mild symptoms may obtain relief by injection of hydrocortisone into the carpal canal —Paul R Lipscomb.]

Median Neuritis (Carpal Tunnel Syndrome) Caused by Gouty Tophi L. Emmerson Ward William H Bickel and Kendall B Corbin[9] (Mayo Clinic and Found) report a case in a man 56 who had had several attacks of acute gouty arthritis during the past 15 years There were gouty tophi in several areas Those on the flexor aspects of the wrists were 3-4 cm in diameter Typical symptoms and signs of the carpal tunnel syndrome were present Examination 4 months after surgical removal of the large tophaceous masses which caused compression of the median nerve in the wrists, revealed marked improvement in strength and sensation in the hands.

To the growing list of conditions recognized as causes of compression of the median nerve beneath the transverse carpal ligament this case adds another, namely gouty tophaceous deposits Proper treatment for gout with uricosuric agents and a diet low in purine may reduce the size of tophi but the process is prolonged and much fibrosis and tissue thickening may remain To afford quicker and more certain relief and to avoid possible permanent damage surgical decompression of the nerve seems advisable.

When the carpal tunnel syndrome is present in its overt form characteristic manifestations include pain paresthesias and sensory deficit in the distribution of the median nerve in the hand and weakness and atrophy in muscles of the hand supplied by the median nerve. Loss of the power of palmar abduction of the thumb may be more marked than weakness of opposition since the adductor pollicis and part of the flexor pollicis brevis which also aid opposition are innervated by the ulnar nerve Often the involvement of the nerve may be incomplete, giving rise to only parts of the syndrome particularly in early stages of development or in mild cases.

(9) J.A.M.A. 167:844-846, June 14 1958

The following confirmatory signs of median neuritis aid in diagnosis Tinel's sign i e tingling in the median distribution produced by tapping over the median nerve at the wrist increased pain in the median distribution as a result of acute flexion or extension of the wrist or temporary ischemia of the extremity and palpation of a tender swollen median nerve just above the transverse carpal ligament.

The authors have found electromyography and measurement of conduction time in the peripheral portion of the median nerve to be of particular diagnostic help The characteristic findings are those of prolonged conduction time from the wrist to the thenar muscles and evidence of denervation in the muscles of the hand supplied by the median nerve. Conduction time may be prolonged when signs of denervation are minimal or absent, as in the present case

► [Although the carpal tunnel syndrome is fairly common, gout as a cause is rare.—Paul R. Lipscomb.]

Carpal Canal Syndrome in Children. Ch. Martin and Paul Massé[1] observed the carpal canal syndrome, which consists of spontaneous compression of the median nerve in the carpal canal in 3 young children within 2 years The syndrome has previously been reported only in adults

Girl, 4 had pain in the palm of the hand for 8 days, which awakened her at night. The hand was red and moist, but palpation or passive movements were not painful. General examination revealed no abnormalities and x rays of the cervical spine were negative. Intermittent pain persisted, especially at night, and did not respond to medication (Phenergan, Nicyl) though hot baths afforded some relief. Pain gradually subsided and disappeared after about 3 weeks. Similar pains recurred in the right hand a year later Vasodilator treatment (Nicyl) was ineffective, but cortisone (8 tablets of 5 mg /day) for 10 days produced definite improvement. A month later severe nocturnal pain occurred in the left hand during the day the child complained of swelling and tingling sensations. A 10-day course of cortisone gave temporary relief but pain recurred almost immediately afterward and persisted for 6 months. During this period, there was intermittent swelling above and below the anterior annular ligament of the carpus, which was not painful to palpation. Pain disappeared for about 5 months then recurred. Operation was performed, with incision of the anterior annular ligament of the carpus. There was no synovial tumor no effusion. The median nerve was dissociated by a soft edema nerve fibers were perfectly visible. The entire content of the carpal canal was dissected to the bone, without encountering any cause for the compression. The skin was closed without reflection of the ligament. After operation, there was no recurrence of pain. At

(1) Arch. franc. pediat. 15 930 940 1958

the last examination, 1½ years after operation, the patient could clench the fist normally

Compression of the median nerve in the carpal canal is easily explained by the local anatomy Limited behind by the hard plane of the bones of the carpus and in front by a hard resistant ligament, the carpal canal is absolutely not extendable. Flexors of the fingers and their sheaths and the median nerve are closely confined and even slight edema of one of these elements can produce painful compression of the nerve. Though usually there is no macroscopic evidence of a lesion at operation surgical treatment is consistently effective. This consists simply of section of the anterior annular ligament of the carpus

The temporary effectiveness of corticotropic hormones in the patient described led to its trial in the other 2 patients. In 1 of the 2, this produced remission of 36 days that began the first day of treatment and in 1 a child who had pain almost continuously for 7 months remission lasted for 15 months Though this hormonal treatment may be useful in certain clinical situations it probably should not lead to rejection of the operation which is the only method by which the nerve can be explored directly

Injured or Abnormal Thumb Recommendations for Treatment are presented by Robert A Murray[2] (Temple Tex.) Functionally, the thumb is a major portion of the hand Because all physicians at times must care for injuries of this digit, they should be familiar with the possibilities of repair In treating acute injuries, reconstruction of the thumb should be as complete as possible or all viable portions of the thumb should be saved by covering the wounds with skin so that subsequent surgical treatment may restore maximum hand function

Superficial skin loss may be replaced easily by applying a thick, split skin graft. At times a full thickness graft may give a more ideal result, but routinely it is not as successful If loss of skin and soft tissue exposes a tendon or bone or if the area requires additional surgical treatment replacement by a pedicle skin graft is indicated To have skin with normal sensation over the tactile surface of the thumb is important.

Laceration of the digital nerves demands repair and fortunately good results can be obtained. Damaged tendons

(2) South. M J 52:845-850 July 1959

are repaired by suture tendon graft or tendon transfer as indicated With mobile joints and adequate covering of soft tissue, tendon repair and replacement usually is more satisfactory in the thumb than in the fingers because in the thumb an incomplete range of motion is functional as long as the fingers can be contracted.

A fracture or dislocation of the thumb demands meticulous treatment for optimum results An unstable or arthritic joint in the thumb usually is best treated by arthrodesis Therapy for ununited fracture should include intramedullary grafting of cancellous bone and internal fixation with fine threaded wires A malunited fracture interfering with function should be corrected by osteotomy and the position should be maintained by Kirschner wire fixation.

Interruption of any of the three major nerves of the arm interferes with function of the thumb The ideal treatment is repair of the nerve. If function does not return tendon transfers are indicated.

Amputation of the thumb should be considered only for gangrene or malignant lesions Otherwise reconstructive procedures are indicated rather than removal of any portion of the thumb

Surgical procedures for replacing a thumb include tubed abdominal pedicle with bone graft implant toe-to-hand transfer transfer of a digit from the other hand transfer of a digit other than the index finger from the same hand and transfer of the index finger or a portion thereof Transfer of the index finger usually is the simplest procedure for pollicization. Though the appearance is abnormal the cosmetic result is better than with other procedures If the nerve supply is maintained and the tendons are preserved or transferred the functional result is excellent.

► [Long and complicated surgical procedures to replace a lost thumb are not often warranted when only one thumb is missing especially is this true if the new thumb will not have normal sensation —Paul R. Lipscomb.]

Level of Amputation in Third Finger Robert E Carroll[3] (New York) observes that the 3d digit of the hand is the main axis in anatomic construction Both abduction and adduction are determined from this point of reference Function closely parallels that of the index finger There is relatively little motion at the base of the index and middle fin

(3) Am. J Surg 9 477-483 April 1959

gers in the carpometacarpal joint This gives stability and power to grasp Both index and middle fingers are the firm opposing post to the pinch of the thumb Removal of any portion of the row of phalanges or metacarpals must be cautious

No amputation should take place through the proximal interphalangeal joint. It is much better to cone off the tip of the proximal phalanx Length must be preserved in this phalanx. A level of less than three fourths of the proximal phalanx is not acceptable

The short stump frequently lacks the pull of the flexor profundus and sublimis tendons It contributes little to grasp and leaves a defect in the cupping of the phalanges The tip of the stump projects from the fist and is traumatized by repeated blows Moreover the presence of this portion of phalanx serves as a block to keep the index and ring fingers apart If only this short portion of the proximal phalanx is to remain it would be better to remove it along with the entire 3d metacarpal Later a better hand can be fashioned by transposition of the index ray to replace the missing 3d digit

It has been said that preservation of the metacarpal head and thus a broad palm, is necessary for the hand of a working man. This is an arbitrary axiom It is especially magnified in amputation at the 3d metacarpophalangeal joint. Here the head of the metacarpal serves to maintain a gap in the grasping hand. The defect prevents handling of small objects at work and especially of coins Furlong believes it is better to resect the metacarpal head down to the narrower shaft The author suggests that a much better hand is produced by one of two alternative methods. The most useful hand is produced by removing the 3d metacarpal and transposing the index ray to replace the 3d finger The other alternative is to resect the 3d metacarpal completely including the base. Often this second method is used when the 3d ray must be excised because of tumor

Ainhum of Fingers Case from Sierra Leone is reported by K Vigors Earle.[4]

Negro man, 38, first noted tightness near the base of the right little finger 5 10 years previously A constricting band gradually developed (*Fig 163*) and the finger became displaced outward and proximally Some 10-15 years before, a similar process in the left ring finger had proceeded to autoamputation. The skin over the distal half of the right 5th metacarpal was finely wrinkled and lighter than the sur

(4) T Roy Soc. Trop Med. & Hyg. 52 570-573, November 1958.

rounding skin. It was adherent to the underlying subcutaneous tissue. Sensation to pinprick and light touch were blunted in this skin area and on the affected little finger Clinical signs of leprosy were absent. Because the little finger was functionless and interfered with the patient's work, it was removed under local anesthesia. The subcutane



Fig. 163 —Ainhum of right little finger (Courtesy of Earle, K. V Tr Roy Soc. Trop. Med. & Hyg. 52:570-573 November 1958.)

ous tissue at the base of the finger was hard, and bleeding from the amputation site was minimal X rays of the amputated specimen revealed absence of the proximal phalanx, attenuation of the middle phalanx and decalcification of the terminal phalanx.

Cases resembling or purported to be ainhum of the fingers have been described by several authors but they appear to have been complications of leprosy or congenital deformities Earle believes that ainhum of the fingers can be diagnosed with certainty only when the patient is a Negro when the condition is chronic and develops slowly in a finger that was previously normal and when leprosy can be definitely excluded.

Physiologic Treatment for Fractures of Metacarpals and Phalanges Examination of the functional anatomy of fractures in the hand and of the rather frequent poor results indicates that poor control of the ray (digit and metacarpal) permits the muscle tendon systems of the hand to distort the

fracture fragments. The usual lack of compression over the injured area permits edema to remain throughout healing with resultant crippling fibrosis

Preston J Burnham[5] (Univ of Utah) describes a method for treatment of fractured phalanges and metacarpals that effectively overcomes these difficulties A specially designed aluminum splint combined with volar cock up plaster cast is used to hold the digits in a position of rest with the opposing muscle-tendon systems at minimal tension. Instead of first reducing the fracture then attempting to splint it the forearm wrist and hand are first splinted The physician s both hands are then free to reduce the fracture and place the digit on the splint.

METHOD.—Anesthesia usually by regional block is first initiated. The aluminum splint is applied to the hand and forearm and easily bent to fit the injured digit. The splint is fixed to the wrist, hand and forearm by laying a padded volar cock-up splint of plaster from the proximal transverse flexion crease of the palm to the proximal end of the forearm. These are held in position with roller gauze. The patient's hand is carefully held in the operator's two hands while the plaster sets to maintain the gentle arch of the metacarpals.

When the plaster is dry the 1st digit is painted with tincture of benzoin. When this is dry a split piece of 1 in. tape is applied to the dorsum of the finger extending only to the fracture site. The fracture is reduced and the digit is laid on the splint and fixed in position by pressing the tape to the underside of the splint. An x ray is taken—this is easily done because the splint is radiolucent—and if the position of the fragments is acceptable, strips of elastic adhesive are placed around the digit and splint to further immobilize the digit, prevent edema and keep the tape in place. An elastic bandage is applied about the hand and wrist.

To dress open wounds the bandage is cut off and the splint depressed. If the digit is not forcefully manipulated, it will remain in the position of rest. After the clean dressing has been applied the distal splint is bent back in place and the digit fastened to the splint as before.

► [This would appear to be an excellent method for the treatment of many fractures of the hand. Some fractures which are unstable after reduction are best immobilized by the use of Kirschner wires.—Paul R. Lipscomb]

Repair for Loss of Tactile Pad of Thumb is described by Robert N Watman and Fred R. Denkewalter[6] (Ohio State Univ)

TECHNIC.—The bone, nail and nailbed of the distal phalanx of the 5th finger are removed, and the filleted phalanx is used as a well vas-

(5) J.A.M.A. 169 663-666, Feb. 14 1959
(6) Am. J Surg. 97:238-240 February 1959

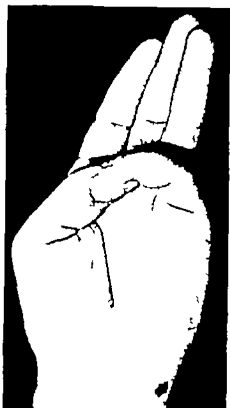


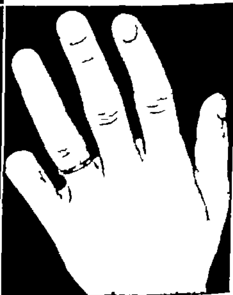
Fig 164 (left) —Hand 10 days after 1st stage procedure.

Fig. 165 (below left) —Palmar view of final result 3 months after injury

Fig 166 (below) —Dorsal view of final result 3 month after injury More of 5th finger usually can be saved.

(Courtesy of Watman, R. N and Denkewalter F R.: Am. J Surg. 97:238-240 February 1959.)





cularized and specialized pedicled graft for the thumb. The hand is dressed and immobilized in "Boy Scout salute" position (Fig. 164). After 2-3 weeks if the graft remains pink indefinitely with a rubber band around the base of the 5th finger, amputation of the terminal phalanx of this finger is completed, the distal end of the reconstructed thumb is shaped and this edge of the graft is sutured.

Results of this type of repair in a patient with avulsion of the soft tissue of the palmar aspect of the distal phalanx of the thumb are shown in Figures 165 and 166. Neurotization was satisfactory though not perfect. In the opinion of a neurosurgical examiner the result was superior to that usually obtained by other methods of repair. The repair tissue was durable and was not tender.

Loss of the distal phalanx of the 5th finger is a cosmetic disadvantage in this treatment method that must be weighed against the advantages of the procedure.

Tenosynovial Osteochondroma in the Hand. Allen F. Murphy (Chicago) and James N. Wilson[7] (Los Angeles) report 2 cases.

CASE 1.—Woman, 52, was struck at the base of the right thumb by a filing-cabinet drawer. Several days later she noted a freely movable nodule at the site of injury. Examination 4 months later revealed a firm, movable tender nodule lying adjacent to the short extensor tendon on the radial side of the right thumb. X-rays revealed calcification in the soft tissue. At surgery a smooth, round osteocartilaginous mass, 0.5 cm. in diameter was found attached to the long abductor tendon sheath by a ¼ in. pedicle. Microscopic examination showed the nodule was composed mainly of hyaline cartilage and osteoid tissue. There had been no recurrence 10 months later.

CASE 2.—Woman, 60, struck the left ring finger on a steel rack in 1918. Several months later a hard, movable mass was noted on the volar aspect of the finger. The mass had been excised on 3 occasions in 1920, 1923 and 1926 but recurred, probably due to incomplete excision. In 1955 examination revealed multiple tumors of the volar aspect of the left ring finger. At operation, four irregular lobulated pieces of cartilaginous tissue were found originating from the flexor tendon sheath. Microscopic examination revealed a capsule, cartilage and a peripheral area of bone. There had been no recurrence 3½ years later.

Though osteochondromas arising from or intimately associated with bone are common, such tumors occurring independent of bone are rare and the pathogenesis is less easily understood. The role of trauma in the pathogenesis of the lesion is speculative. In the authors' patients trauma probably precipitated a focus of irritation, directing the patient's attention to the area of tumor growth.

(7) J. Bone & Joint Surg. 40-A:1236-1240, December 1958.

Use of Free Full Thickness Skin Grafts in Treatment of Cutaneous Defects with Special Reference to Hand Injuries. According to Wayne F Cameron and Thomas A Gibson[8] (Ontario Calif) the 98% full thickness skin graft is most suitable for repair of a large proportion of the major defects of the cutaneous tissues of the hands It is equally adaptable to defects of the fingertips the palm or the dorsum The size of the defect is not a limiting factor as may be commonly supposed

TECHNIC.—The area to be grafted is adequately excised. Particular account must be taken of the natural skin creases of the hand so that the graft margins will be congruent with Langer's lines and the occurrence of discouraging contracted keloids is thus obviated. Often, this means excising healthy tissue so that the graft borders do not cross a skin crease or lie in the central portion of the finger When crossing a skin crease is unavoidable the graft margins must be zigzagged or curved so that contracture will not occur

A pattern is made of the defect, using fine mesh gauze or crinoline and the pattern is traced on the donor site with a scalpel. The abdomen and inner aspect of the thigh are especially suitable donor sites because large defects in these areas may usually be closed by primary suture or by primary suture plus use of a small split-thickness graft to any remaining defect.

The graft is transferred to its new position and retained by several 4-0 black silk sutures, the ends of which are left long The margins of the graft are accurately sutured with an over and-over basting stitch of 5-0 nylon. A stent is fashioned from a roll of fluffed gauze that has been lightly moistened with saline and covered with a single layer of petrolatum gauze. This is applied to the graft and retained in place by tying over it the ends of the previously left long sutures.

The forearm and hand must be completely immobilized. The primary dressing is maintained for 8-10 days. At the first dressing the graft usually appears cyanotic, but also is moist and pliable. Within about 3 weeks, the hand is completely healed and will resist the ordinary trauma of everyday life.

The 98% full thickness graft contains no subcutaneous tissue, and the authors specifically leave a thin layer of corium at the donor site When this is done and proper precautions of technic in their elevation and application are followed these grafts will give an almost universal 100% take.

► [There is a place in surgery of the hand for the split thickness, full thickness and pedicle skin grafts. Rarely if ever should a full-thickness graft be applied to a potentially infected granulating bed. There is cumulative evidence that dressings applied to grafts in noninfected sites are best left undisturbed for 2 3 weeks —Paul R. Lipscomb.]

Finger Tip Injuries and Their Management. Finger tip

(8) West. J Surg. 67 278-279 Sept.-Oct. 1959

injuries are serious wounds whose importance to the patient far exceeds the extent of tissue damage noted Meticulous cleansing and adequate debridement are essential

Harold E. Kleinert[9] (Univ of Louisville) emphasizes that choice of treatment must always be related to the principles of maximum conservation of tissue and finger function The

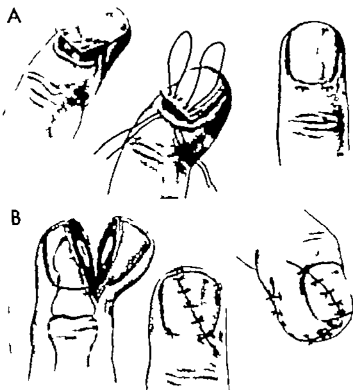


Fig 167 —*A* nail avulsed and matrix of nail partially torn away Matrix accurately replaced with absorbable 5 0 catgut sutures. *B* sharp laceration extending through nail, soft tissue and bone accurately approximated by sutures placed through nail. (Courtesy of Kleinert, H. E.: Am. Surgeon 25 41 51 January 1959)

type of repair should be intelligently related to the patient s occupation and the type of function required in the hand Bleeding is usually controlled by mild pressure or twisting of the bleeding vessels because use of ligatures may form a painful lump at the repair site

Severely contused pulp with hematoma formation is treated by incision and drainage. Subungual hematoma is treated by drilling a hole in the nail Avulsion lacerations of less than 1 cm in diameter if bone is not exposed require no treatment other than thorough gentle cleansing applica

(9) Am. Surgeon 25 41 51 January 1959

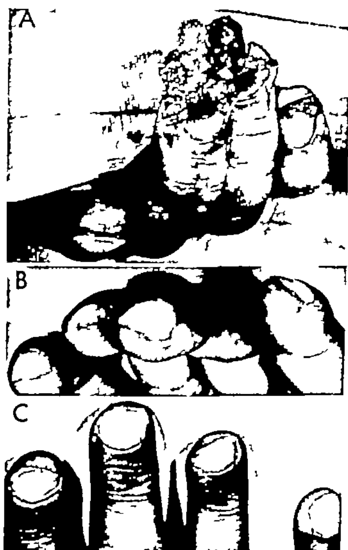


Fig 168.—*A* preoperative view of compound fractures and crushing lacerations of several finger tips. *B* and *C* same hand 3 months after removal of devitalized tissue and local reconstruction. (Courtesy of Kleinert, H. E. Am. Surgeon 25:41 51, January 1959)

tion of fine mesh gauze and a dry sterile dressing Wounds of more than 1 cm in diameter without exposure of bone, are treated by applying a heavy split thickness or full thickness graft from the volar surface of the forearm

Avulsion wounds of the nail and nail matrix when the matrix is viable, are treated by excision of the remaining nail and replacement of the matrix with fine absorbable sutures (Fig 167 *A*) Sharp lacerations through the nail soft tissue and bony phalanx, provided one of the neurovascular bun

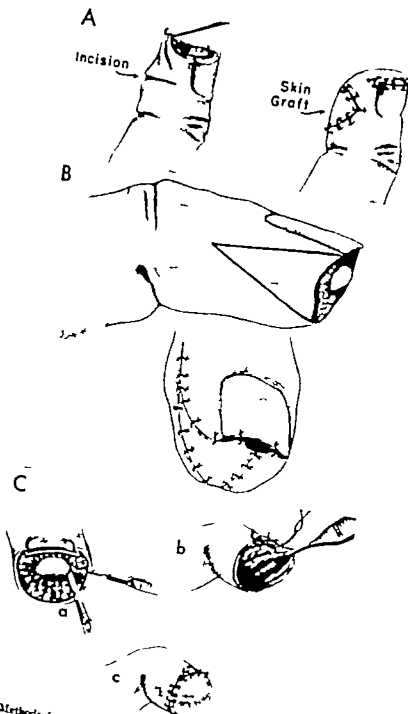


Fig 169 —Methods for local revision of amputated finger tips. *A* ventral "knight's hood" method of finger repair. Heavy split-thickness graft covers defect left by relaxing incision. *B* bilateral V-incisions sutured together to close amputation stump. This method tends to leave pointed, scarred finger tip. *C* sliding fat graft: pulp separated from skin and bone for cm., as in *a*; fibrofatty pulp mobilized over exposed bone and sutured to nail bed (*b*); full-thickness or heavy split-thickness graft applied over exposed pulp (*c*). (Courtesy of Kleinert, H. E. Am. Surgeon 25:41 51 January 1959.)

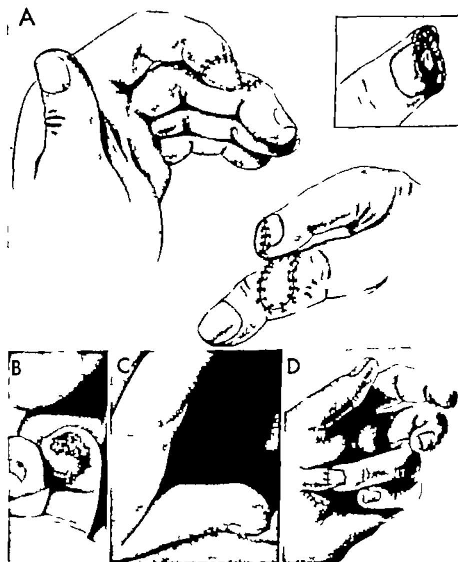


Fig. 170 —*A* cross finger flap to reconstruct amputated tip of index finger Donor site dorsal surface of middle phalanx of middle finger *B* appearance of cross-finger flap to amputated tip of ring finger in child, aged 18 months, at first dressing change (7 days) Donor site is middle finger *C* final result of cross-finger flap from index finger to reconstruct amputated tip of thumb. *D* thenar flap to reconstruct amputated tip of ring finger Heavy split-thickness graft over donor site. This is preferable to hypothenar flap regardless of finger involved. (Courtesy of Kleinert, H. E. Am. Surgeon 25 41 51, January 1959)

dles is intact, are repaired by placing sutures through the skin and fingernail (Fig 167 *B*) Compound fractures of the distal phalanx with varying degrees of soft tissue destruction are reconstructed if the tip remains viable (Fig 168)

Complete amputation of a finger tip depending on asso-

ciated factors is treated by proximal amputation local revision or reconstruction with pedicle grafts Proximal amputation is most often indicated in oblique laceration of the finger tip when the patient desires to return to work in a short time. Proximal amputation is also indicated in patients with pre-existing diseases of the hand such as arthritis vascular or skin disorders Local revision (Fig 169) necessitates immobilization of the injured finger only but may result in a finger tip that is somewhat more pointed than usual has inadequate padding or is shorter than a finger tip reconstructed by various flap methods Extensive injuries require more complex reconstructive procedures such as cross-finger flaps (Fig 170 *A-C*) thenar flaps (*D*) palmar flaps and pedicle grafts from other areas When possible skin from the hand should be used for reconstruction because it contains special sense organs not found in other skin except that of the feet.

► [*This is an excellent article and should be read in its entirety by those who care for acute injuries of the hand.—Paul R. Lipscomb.*]

Severe Compression Injuries of Hand in Industry Amputation versus Rehabilitation Michael L. Lewin[1] (New York) describes a rehabilitation program undertaken in the treatment of about 25 patients with severe compression injuries of the hand. In most, the injury caused severe thermal burns besides crushing and avulsion of tissue The common characteristic of all injuries was massive necrosis of soft tissues The bone if it escaped fracture and comminution was fairly resistant to compression and heat. Time of debridement was governed by time of formation of a firm eschar (Figs 171 and 172) When adequate debridement could be done and the wound was free from infection definitive resurfacing with a flap was performed However in most cases all necrotic foci could not be eradicated In such cases the immediate aim was to obtain a temporary epithelial cover with split grafts (Fig 173) thus minimizing secondary damage by infection and exposure. Further debridements were carried out as separate procedures or during dressings and as soon as areas of granulation appeared they were covered with split grafts

In a few weeks after initiation of treatment, the entire wound consisted of islands of denuded bone and exposed

(1) J Bone & Joint Surg 41 A 71 87 January 1959

joints The phalangeal joints usually were promptly obliterated However, the larger joints formed deep pockets from which necrosis and infection had to be eradicated before the cavities filled with granulation tissue. To accomplish this



Fig 171 (top) —Excision of eschar 3 weeks after injury in typical compression burn of dorsum of hand.
Fig. 172 (bottom) —Result of primary debridement.
(Courtesy of Lewin, M L. J Bone & Joint Surg 41 A 71-87 January 1959.)

these pockets were lightly packed and the extremity was splinted in plaster maintaining functional position (Fig 174) Exposed bone was treated by drilling multiple holes through the cortex, thus allowing buds of granulation to sprout from the marrow

Practically all cases required resurfacing with a flap with a substantial subcutaneous pad to supply a stable tegumental cover to allow revascularization of damaged bone, to

permit an operative approach to deep structures later and to fill in the contour defect. As soon as feasible passive and active exercises were started and dynamic splinting was substituted for the static splinting used during the acute



Fig. 173 (top).—After first skin grafting.
Fig. 174 (bottom).—Note functional position of hand. Some metacarpals, phalanges and fragment of ulna are still exposed and are treated by drilling and decortication before temporary resurfacing is completed.
(Courtesy of Lewin, M. L.: J. Bone & Joint Surg. 41-A: 71-87, January, 1959.)

phase. Two to 6 months were allowed to elapse before kinetic replacement was considered. It consisted of replacement of missing tendons of the wrists and fingers and occasionally in improvement of opposition in injuries of the thenar area.

Permanent disability in dorsal hand injuries consisted of limitation of function of the joint and reduced strength

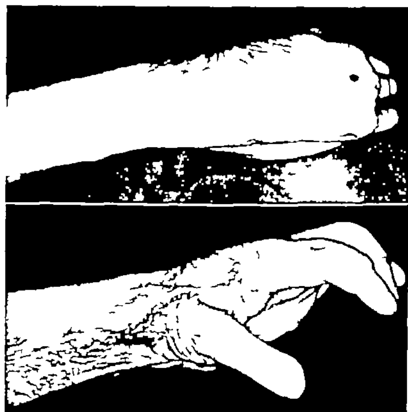


Fig 175 (top) —Abdominal flap covering fingers, mitten fashion.
Fig 176 (bottom) —Final result after separation of fingers and after multiple tendon grafts from foot to substitute for extensors.
(Courtesy of Lewin, M. L. J Bone & Joint Surg. 41 A 71-87 January 1959.)

Serviceable grasp and pinch mechanisms were established in all cases Palmar and volar injuries have a poorer rehabilitative prognosis Structural restoration of the hand is of little value unless there will be serviceable sensation and function

Spontaneous Rupture of Extensor Pollicis Longus Tendon in Rheumatoid Arthritis of 3 years duration was observed by Carlo Sorell[2] in a woman aged 49 The local pathologic changes that brought about spontaneous rupture of the tendon probably consisted of a rheumatoid tenosynovitis of the wrist rather than true rheumatoid arthritis This opinion is based on negative x ray findings and on the fact that the patient had a complete range of motion in the involved wrist Histologic confirmation was impossible because surgical treatment was refused by the patient in view

(2) Bull. Hosp. Joint Dis 19 65 71 April, 1958

of an unusually satisfactory return of function after about 6 months

Sorell refers to Kaplan's *The Anatomy of the Hand* for an explanation of the spontaneous functional improvement in this patient Not infrequently, the extensor pollicis brevis has a portion of its fibers inserted into the distal phalanx. In addition, the long and short extensors of the thumb receive fibers of expansion across the metacarpophalangeal joint the fibers uniting with the tendons to form an extensor apparatus analogous to the one observed on the dorsal aspect of the fingers Those fibers of expansion derive on the medial aspect, from the adductor pollicis and on the radial aspect, from the abductor brevis and the flexor brevis This arrangement permits independent extension of the distal phalanx, by traction applied to the tendon of the extensor pollicis brevis when it is inserted into the distal phalanx or by the effect of the thenar muscles of the thumb adductor on the ulnar and abductor and flexor on the radial side which contribute to the formation of the dorsal extensor apparatus

► [Most spontaneous ruptures of the extensor pollicis longus tendon result from fraying and laceration of the tendon by a sharp spicule or edge of bone following a fracture of the distal radius.—Paul R. Lipscomb]

Experiences With Finger Joint Prosthesis Earl W Brannon and Gerold Klein[3] (Lackland Air Force Hosp) devised a prosthesis for irreparably damaged finger joints It is a replica of the normal joint and replaces the whole joint. It is fabricated of titanium and consists of two parts joined by a simple hinge joint which is locked by a half-threaded rivet screw Each part has an intramedullary stem for insertion into the bones of the finger The intramedullary stem is triangular and designed to prevent rotation of the finger after insertion. A recent addition is the placement of a staple through each hub and stem portion to prevent sinking of the prosthesis into the phalanx after bone resorption occurs

Prerequisites for use of the prosthesis are functionally restorable tendons intact nerve supply adequate circulation and good motivation The prosthesis was originally designed to replace a damaged proximal interphalangeal joint which had resulted in a stiff useless finger but it may also be used to replace a damaged or diseased metacarpophalangeal joint

(3) J Bone & Joint Surg 41 A:87 102, January 1959

The authors have used the prosthesis in 14 patients with joint defects secondary to trauma They were referred for arthrodesis or amputation The interval between injury and replacement arthroplasty varied from 3 months to 2 years. The interphalangeal joint was replaced in 12 patients and the metacarpophalangeal joint in 2

Follow up has ranged from 10 to 39 months in 12 patients. All have returned to full military duty and are engaged in occupations requiring use of the hands Results were considered excellent or satisfactory in 10 A functional range of painless motion was restored and the cosmetic appearance of the hand was improved. In 2 patients results were considered unsatisfactory because of slight ulnar angulation due to migration of the stem of the prosthesis in the proximal phalanx. These 2 patients were treated before staples were added to the prosthesis As yet none of the prostheses anchored with staples has shown a tendency to migrate.

► [This surgical procedure is at present applicable for a few selected patients In general the policy should be to preserve and restore, by arthroplasty motion in metacarpophalangeal joints and obliterate painful or unstable motion in interphalangeal joints by arthrodesis.—Paul R. Lipscomb.]

AMPUTATIONS AND PROSTHESES

Sites of Election for Amputation and After Treatment of Amputation Stumps. After treatment of arm and leg stumps should begin, according to Allan MacDonald[4] (Auckland) before the limb is amputated The prospective amputee should be told by the surgeon that he will feel a phantom foot or hand after the limb has been removed that this is a natural normal phenomenon and that, provided he does not let his mind become fixed on the phantom limb it will gradually fade Fading will occur in most patients provided surgery has been correct, nerve trunks have merely been gently drawn down divided with a clean cut and allowed to retract and have not become involved in carelessly applied ligatures or the patient was not given any other treatment and also provided there was no prolonged suppuration The patient who is not warned of the inevitable phantom limb is more likely to brood on it and get well

(4) New Zealand M J 58 44-48 February 1959

delineated pain pathways to the sensorium The less that is done to the stump, except for postoperative firm bandaging and active exercises, the better it will be for him Massage or physiotherapy of any sort is definitely contraindicated If there is any local cause for pain in the stump, it may be a matter for surgical intervention, but most of the pain that the amputee feels is central in origin and any form of local attention to the stump other than exercising it and bandaging is incorrect and uncalled for and will keep his mind centered on the stump The sooner he can be fitted with an artificial arm or leg and start to use it the better

A proportion of patients continue to have pain Amputees are a fairly even cross section of the population as a whole and include among themselves the usual percentage of those with unstable temperaments Those who continue to complain of excruciating stump pain and phantoms are usually from this class Treatment here again is not local to the stump provided there is no adherent nerve root that is being pulled on and the socket and leg fit properly Treatment is general and here the psychiatrist can help Massaging the stump or plying it with any sort of heat light sound electricity or magnetism will do no good but will in fact intensify the trouble

► [This is an excellent paper and provides much food for thought. It should be emphasized, however that amputation surgery in trauma and amputation surgery in occlusive arterial disease are two entirely different fields of endeavor and the principles that hold in one are generally untenable in the other Much grief in amputation surgery stems from the failure to recognize this fact. However the section in this article on "after treatment" contains much sound information applicable to both groups and should be recommended reading for the surgeon who amputates infrequently—John C. Ivins.]

Cineplasty Historical Review Present Status and Critical Evaluation of 64 Patients Robert Mazet Jr[5] (Los Angeles) made detailed follow-up studies on 44 patients with 56 muscle tunnels Follow up ranged from 19 months to 18 years with 1 exception. At cineplasty the age range was 8-49 Most of the patients were young generally healthy male veterans Most followed sedentary occupations but among the successful wearers were 2 heavy-equipment operators 2 lumber mill hands 1 welder and 1 racing-car driver

Of the 56 tunnels only 25 were used. Below the-elbow biceps tunnels were successful in 19 of 27 instances pectoral

(5) J Bone & Joint Surg 40-A 1389-1400 December 1958

tunnels were successful in 6 of 12 instances None of 15 forearm or 2 triceps tunnels was used.

Twenty additional patients with 24 tunnels were examined at the regional office of the Veterans Administration, San Francisco Among the 64 patients with 80 tunnels were 11 failures in 39 biceps tunnels (72% successful) and 8 failures in 17 pectoral tunnels (53% successful) All triceps and forearm tunnels were failures

Mazet concludes that cineplastic muscle tunnels and prostheses made according to present technologic methods in properly selected patients are generally adequate. The causes of failure in order of importance were (1) injudicious selection of candidates (2) lack of patient cooperation in learning to use the prosthesis, (3) in the forearm the technical impossibility of constructing muscle tunnels with sufficient strength and excursion (4) recurrent excoriation of tunnel skin with resulting narrowing or closure of the skin tube orifice (5) rotation of prosthesis on the shoulder when the tunneled muscle was contracted (6) insufficient transmission of force through the cable system (7) limitation of excursion because of reattachment of the severed distal end of the canalized muscle to deep tissue and (8) the patient s lack of real need for a prosthetic device.

Prerequisites for successful use of cineplasty tunnels include (1) a mature intelligent, well adjusted patient. In general he should not be engaged in heavy labor He should have observed others who have had cineplasty and should ask for the operation He should have exhibited good use of a conventional device for 6 months Only in exceptional circumstances should cineplasty be done before the patient is age 15 (2) The prosthetist must be competent, one who will make a well functioning and properly fitted device. (3) Preoperatively an adequate program of joint mobilization and muscle strengthening should be carried out and postoperatively training in prosthetic use (4) When a biceps tunnel is contemplated an amputation stump should be well muscled covered by good skin with normal innervation and there should be relatively normal shoulder motion (5) Daily tunnel hygiene must be exercised

Biceps Cineplasty for Forearm Amputees is described by J T Hueston[6] (Melbourne) *In biceps cineplasty the ef*

(6) Australian & New Zealand J Surg 28 280-285 May 1959

fective insertion of the biceps humeri is transferred from the radius to a skin tunnel passing through the distal part of its muscle belly To accommodate for this dramatic change in its function and to increase the independence of cortical control over this new function intensive pre and postoperative muscle training programs are essential

TECHNIC.—The method used is that followed by Spittler and Fletcher using a 3½ in. square skin flap based over the medial intermuscular septum 3 in. above the medial humeral epicondyle. This is tubed with the skin innermost. After isolation of the biceps, preserving its nerve supply the tendon of insertion is divided and oversewn. A tunnel is made through the muscle belly immediately above the tendinous line, taking care to split rather than divide the muscle fibers until 2 fingers are easily admitted. The skin tube is drawn through this muscle tunnel and sutured to the lateral wound margin with cranial rotation through a right angle to bring its suture line proximally and out of the future pressure area of the tunnel. A thick dermatome graft is used to resurface the exposed muscle belly

Early resumption of the limb function is important and within 2 weeks of operation elbow movement is encouraged, without biceps participation During the 3d week when the wound is healed static contraction of the biceps is begun, often using simultaneous contraction of biceps on the sound side to help in early re-education

The standard required before commencing to use a prosthesis is a pull of at least 15 lb through a tunnel excursion of 1½ in. This is usually attained during the 2d month when the prosthesis may be fitted.

In such a confined space as the muscle tunnel there is little escape for sweat and other skin secretions so that the lining skin becomes moist and greasy

Two types of split hook have been used a voluntary opening and a voluntary closing type

The most obvious advantage of these prostheses is the freedom from the encumbrance of shoulder harness

► [Cineplasty is at present the highest refinement of amputation surgery It is relatively infrequently performed and then usually only in large centers and on very carefully selected patients. Teamwork of the highest order between patient, surgeon, prosthetist and physiatrist is mandatory It is definitely a difficult surgical procedure to be carried out and only by the most experienced people in ideal circumstances.—John C. Ivins.]

Concentration of Penicillin in Ischemic Tissue after Intramuscular Injection was studied by John A Spittel, Jr William J Martin Fordyce R. Heilman Joseph M Janes and Richard M Shick[7] (Mayo Clinic) Procaine penicillin G

(7) J Lab. & Clin Med. 54:599-602, October 1959

600 000 units was given intramuscularly every 12 hours to 18 patients undergoing amputation of 20 limbs. Four received 2 preoperative injections the others received more.

Measurable levels of antibiotic activity (mean value of 2 6 units/ml were found in the serums of all of the patients Detectable amounts of penicillin averaging 15-20% of serum concentrations were found in all samples of tissues excised from the proximal part of the 20 amputated limbs 30-60 minutes after operation Samples of tissues from the distal part of 14 limbs also demonstrated antibiotic activity

It has been the authors clinical impression that certain infected ischemic lesions particularly in diabetic patients, have been benefited by appropriate antibiotic therapy The results of this study support this clinical impression in that detectable concentrations of penicillin usually were found in ischemic tissues Regardless of whether the tissues contain the penicillin or whether the vessels in the tissues contain the agent that has been measured administration of penicillin to patients with such limbs who have infections susceptible to this agent is indicated.

PERIPHERAL VASCULAR SURGERY

Peripheral Vascular Surgery from Standpoint of Orthopedic Surgeon is described by Joseph M Janes[8] (Mayo Clinic) The orthopedic surgeon is particularly concerned with vascular trauma because injuries to blood vessels can complicate what otherwise would be a relatively simple problem in orthopedics

Congenital arteriovenous fistulas are usually multiple and therefore it is difficult to treat them surgically The four cardinal principles in dealing with a peripheral arterial emergency are do not delay do not heat do not elevate and do not refrigerate

If the radial pulse is not palpable after a supracondylar fracture it may become palpable after closed reduction of the fracture. When this occurs routine treatment may be followed with care being taken to watch the state of the circulation closely for at least 48 hours If after manipulation the pulse does not return or disappears and signs of early is

(8) Minnesota Med 42 105-114 February 1959

chemia begin such as pain swelling coldness, cyanosis or pallor and loss of finger motion, definite action is indicated When circulatory embarrassment persists after elbow flexion has been lessened and constricting bandages removed, the lower portion of the brachial artery should be explored

On exposure of the brachial artery, one of these conditions may be found the artery may be in spasm contused with resultant thrombus formation lacerated or completely severed If the artery is in spasm, bathing it with warm isotonic solution of sodium chloride or procaine hydrochloride or wrapping it with a sponge soaked in 2.5% solution of papaverine sulfate often brings about relaxation of the spasm If the artery is so contused that the intima is damaged leading to thrombus formation, arteriectomy is advised. If the artery is lacerated by a bone spicule, it is better to divide the vessel completely

Fracture through the upper third of the tibia can jeopardize the arterial supply to the distal portion of the leg and the foot because of the proximity of the bifurcation of the popliteal artery Amputation usually is necessary when an extremity is fractured at or beyond the arterial injury

In penetrating wounds caused by miscellaneous sharp objects the main artery may be completely divided lacerated or contused with resultant thrombosis or put into a state of spasm As a first aid measure, direct pressure on the artery above the wound will control most of the bleeding when an artery is severed. Immediate exploration is indicated in such instances When a large artery such as the common femoral or popliteal, is completely severed restoration of the continuity of the vessel must be considered.

Vascular Injuries in the Orthopedic Patient are evaluated by Carl W Hughes[9] (Tripler U S Army Hosp Honolulu) In patients with vascular injuries resuscitation, evaluation of injuries and restoration of blood supply should be accomplished at the earliest possible moment After proper exposure and control of the involved vessel repair may be done in one of several ways. Minimal laceration may be repaired by simple suture More severely injured vessels require debridement with anastomosis when possible When a defect exists that is too great for apposition of the vessel ends a graft of homologous artery autogenous vein or possibly

(9) J Bone & Joint Surg 40-A 1271-1280 December 1958.

woven plastic material is indicated. After repair the v must be covered with the surrounding tissues for nou ment and protection

Patency of the major vascular channel is not always essary for limb survival but is desirable. *Ligation of a v* may be indicated if the surgeon is untrained in vascular gery or lacks proper instruments if other priority sur prolongs the operating time excessively if a number o tients are awaiting lifesaving surgery or if the injured v runs through a large avulsed soft tissue wound wher tissue remains to cover the vessel

Ideally, if a surgeon trained in vascular repair is avail the vascular injury producing a pulsating hematoma sh be repaired immediately However, if the surgeon who is familiar with these injuries opens such a lesion wit proper vascular control, he may lose a life or be forced t gate the vessels and possibly lose a limb Though risk of loss is not as great if the artery feeding a pulsating hemat is ligated some days after injury as it is from ligation c acutely damaged artery some functional impairment of limb still occurs

Fracture associated with disruption of the main art channel is one of the more serious complications enc tered by the orthopedist. With vascular disruption at level of the fracture application of the desired pres dressing for control of hemorrhage is more difficult. Any tion of the fractured bones may increase bleeding If vasc repair is possible the fracture should be reduced mann with the vessel visualized to be sure that it is not under due tension separated or that spasm does not result Pre tions as to vessel length also must be taken during rep near fractures about joints

Use of a cast is undesirable for extremities that have b ischemic *Ischemic extremities often tend to swell after t* blood supply is returned Irreversible changes may deve in muscle in tight compartments when hidden by a c An improperly sutured vessel may leak and produce hid hemorrhage or swelling Failure of thrombosis of the a rial repair is more likely to be overlooked in a cast If a c must be used and bivalved for safety of the arterial rep it loses much of its usefulness for treating the fracture.

Traction also offers disadvantages It is desirable to h

the extremity with newly established blood supply near the heart level but the extremity in traction is elevated The fixation of traction or a cast encourages arterial and venous thrombosis Late hemorrhage has been observed from partial separation of an arterial anastomosis due to traction

Orthopedic injuries may complicate the repair of vascular injuries It is difficult in many fractures and dislocations to determine whether absence of a pulse results because of compression by bone fragments thrombosis spasm or a severed artery Presence of hematoma suggests tear in the artery, but may result from widespread destruction of soft tissue and collateral vessels Prognosis of such injuries in the past has been poor for the extremity and sometimes for life. Now that reconstitution of arterial channels is practical, restoration of vessel continuity should be emphasized

Vascular Injuries Complicating Fractures. According to William J Riley[1] (Richmond Va) fractures by which the circulation is most imperiled are those of the lower end of the humerus the upper parts of both bones of the forearm the shaft and lower end of the femur and the upper two thirds of the leg bones Actual gangrene complicating fracture occurs most often when both anterior and posterior tibial arteries are injured by high fracture of the tibial shaft.

There are many types of arterial injury complicating fractures Arterial spasm rupture and perforation contusion pulsating hematoma and traumatic aneurysm are common Reflex vasospasm is a useful protection against fatal hemorrhage after severe arterial injury but for this protection the patient may undergo ischemic contracture or even gangrene. The reflex character of the spasm is suggested by its widespread distribution and by the relief which usually follows removal of the source of afferent impulses by resection of the injured segment of artery or by interruption of the sympathetic reflex through paravertebral Novacain injection spinal or brachial anesthesia or operative sympathectomy

Treatment of traumatic ischemia includes removal of external pressure, maintenance of blood pressure and use of sympathetic nerve block or epidural anesthesia, semi Fowler's position sheet cradle operative exposure of the site of obstruction fasciotomy anticoagulants and antibiotics. All encircling bandages and plaster casts must be removed and

(1) Am. Surgeon 25:115-122 February 1959

all traction apparatus relaxed The limb should be placed in the most comfortable position slung on a Thomas splint or simply supported by pillows while general treatment is begun Intravenous fluids and/or blood should be administered at once, for adequate blood pressure is important. At exploration the occluded vessel is released and widely exposed reparable lesions should be repaired. However irreparable damage is often found and arterectomy with or without grafting is necessary

► [With the recent increased interest in vascular surgery more attention has been directed toward the vascular injuries which complicate fractures Certainly more efficient methods of attacking the problems have been developed and anyone who is in a position to care for fractures or who is called on to do so should not only be cognizant of the problem of vascular injuries as they complicate fractures but also be prepared to take care of the vascular injuries as well as the fracture itself. Needless to say it is useless to save an extremity by having a fracture unite only to lose the portion of the extremity distal to it because of failure to care for the injury that occurs to the blood vessels.—John C. Ivins.]

Femoropopliteal Arteriovenous Aneurysm Caused by Fractured Osteochondroma of Femur Arthur J Lesser and Charles E Greeley[2] report a case

Boy 14 had a pulsating mass measuring 15×10 cm. on the inside of the right thigh. It was only partly compressible and a marked systolic and diastolic thrill and bruit were present. The thrill and bruit could be stopped by compression of the femoral artery above the aneu-

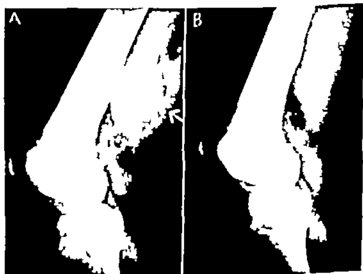


Fig 177.—A femoral angiogram outlining aneurysmal sac with fractured osteochondroma in center B, 5½ months after operation (Courtesy of Lesser A. J and Greeley C. E.: J.A.M.A. 167 1830-1833 Aug 9 1958.)

(2) J.A.M.A. 167 1830-1833 Aug 9 1958.

rysm. The right femoral pulse was pounding, but there was no right dorsalis pedis and no posterior tibial pulse palpable. A femoral angiogram confirmed the diagnosis of aneurysm and showed a fractured osteochondroma protruding into its center (Fig 177 *A*) At age 8, the patient had been found on the floor in a faint, and complained of severe pain in the right knee. At that time he probably underwent a

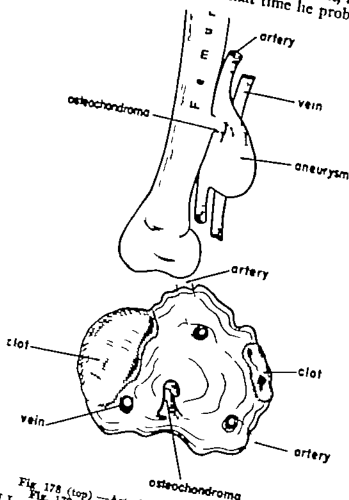


Fig 178 (top) —Arteriovenous aneurysm in situ.
Fig. 179 (bottom) —Opened aneurysmal sac.
(Courtesy of Lesser A. J., and Greeley C. E. J.A.M.A. 167 1830-1833 Aug. 9 1958.)

fracture of the osteochondroma, with the fragment penetrating the artery and vein, causing formation of an arteriovenous fistula. The latter subsequently dilated into a true arteriovenous aneurysm. At operation the aneurysmal sac (Fig 178) was removed, and circulation was restored by end-to-end anastomosis of the artery and repair of the vein. The opened aneurysmal sac showed blood clots and two arterial and one main venous opening (Fig 179). There were no postoperative complications. X ray examination 5½ months after surgery revealed normal bone structure (Fig 177 *B*)

► [This paper and others appearing in the literature emphasize the fact

that today the orthopedic surgeon must be trained to carry out a vascular examination as part of his evaluation of the injured or diseased extremity. Furthermore, he must be sufficiently skilled in the basic technics of vascular surgery to be able to deal with problems encountered in the injured limb and must have sufficient general awareness of vascular disease to be able to consider a differential diagnosis. These are basic requirements.—John C. Ivins.]

EXPERIMENTAL ORTHOPEDIC SURGERY

Experimental Spasmodic Torticollis was carried out by Eldon L. Foltz, Lawrence M. Knopp and Arthur A. Ward, Jr.[3] (Univ. of Washington). Spasmodic torticollis is an involuntary hyperkinesis involving the muscles of the neck primarily on one side. Characteristically, paroxysms of moderate to severe muscle contractions occur that may be painful, and the resulting deformities of head rotation and neck flexion may be functionally incapacitating. The neck muscles mainly involved in this abnormal involuntary movement are the sternocleidomastoid, trapezius, splenius and the scalenes, though almost all of the ipsilateral muscles are involved to some degree. The bizarre posturing of the head that results is often striking and disabling, consisting of strong clonic tonic lateral flexion of the head, rotation of the head with occiput toward the same side, combined with torsion of the head toward the side of flexion. It has been shown that there is usually bilateral involvement of the neck muscles and at times strong elements of head retroflexion are present.

The authors induced experimental spasmodic torticollis in 7 monkeys by lesions in the mesencephalic tegmentum. The etiologic lesion common to all 7 animals involved the central core of the mesencephalic tegmentum at the level of the decussation of the brachium conjunctivum. Though many of the lesions resulted in widespread damage to mesencephalic structures, spasmodic torticollis was still obtained with a very focal, restricted lesion fortuitously placed in this critical region.

In all of the animals, the direction of torticollis was to the side opposite the lesion.

If there is a similarity between the torsion of the head described by others and the spasmodic torticollis noted in the

(3) J. Neurosurg. 16:55-72, January, 1959.

test animals, certain inferences regarding the anatomic substrates involved can be drawn Though the medial longitudinal fasciculus was involved in all of the animals, Carpenter has shown that lesions of this structure are not essential to the production of torticollis Because lesions confined to the brachium conjunctivum before it becomes embedded in the reticular formation do not result in torticollis it may be that destruction of the brachium conjunctivum at its decussation is not essential

Vascular Response to Fracture of Tibia in the Rat. James B Wray and Clifford J Lynch[4] (Bowman Gray School of Medicine) found that a measurable enlargement of the local vascular bed of the rat occurs after a closed fracture of

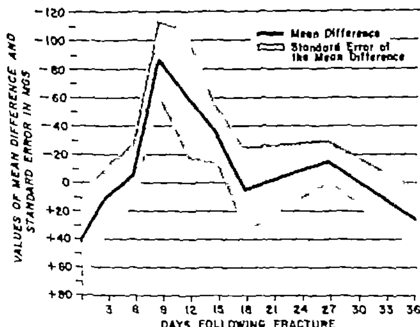


Fig 180.—Curve showing rise and fall of vascular response after fracture of tibia in rat. Values of mean differences in milligrams are plotted against number of days after fracture and are noted as solid black line. Stippled band represents range of standard error of mean differences. (Courtesy of Wray J B and Lynch, C. J: J Bone & Joint Surg 41 A:1143-1148 September 1959)

the tibia. This process reaches a peak at 9 days (Fig 180) then gradually subsides to control levels with union of the fracture. Other writers have used the words hyperemia or "inflammation in describing the vascular phenomena associated with fracture The changes observed by the authors might more exactly be described by the word 'hyperplasia

(4) J Bone & Joint Surg 41 A 1143-1148 September 1959

that today the orthopedic surgeon must be trained to carry out a vascular examination as part of his evaluation of the injured or diseased extremity Furthermore, he must be sufficiently skilled in the basic technics of vascular surgery to be able to deal with problems encountered in the injured limb and must have sufficient general awareness of vascular disease to be able to consider a differential diagnosis. These are basic requirements.—John C. Ivins.]

EXPERIMENTAL ORTHOPEDIC SURGERY

Experimental Spasmodic Torticollis was carried out by Eldon L. Foltz Lawrence M Knopp and Arthur A Ward, Jr[3] (Univ of Washington) Spasmodic torticollis is an involuntary hyperkinesis involving the muscles of the neck primarily on one side Characteristically paroxysms of moderate to severe muscle contractions occur that may be painful and the resulting deformities of head rotation and neck flexion may be functionally incapacitating The neck muscles mainly involved in this abnormal involuntary movement are the sternocleidomastoid trapezius splenius and the scalenes though almost all of the ipsilateral muscles are involved to some degree The bizarre posturing of the head that results is often striking and disabling consisting of strong clonic tonic lateral flexion of the head rotation of the head with occiput toward the same side combined with torsion of the head toward the side of flexion It has been shown that there is usually bilateral involvement of the neck muscles and at times strong elements of head retroflexion are present.

The authors induced experimental spasmodic torticollis in 7 monkeys by lesions in the mesencephalic tegmentum The etiologic lesion common to all 7 animals involved the central core of the mesencephalic tegmentum at the level of the decussation of the brachium conjunctivum. Though many of the lesions resulted in widespread damage to mesencephalic structures spasmodic torticollis was still obtained with a very focal restricted lesion fortuitously placed in this critical region

In all of the animals the direction of torticollis was to the side opposite the lesion

If there is a similarity between the torsion of the head described by others and the spasmodic torticollis noted in the

(3) J Neurosurg 16 55 72 January 1959

test animals, certain inferences regarding the anatomic substrates involved can be drawn *Though the medial longitudinal fasciculus was involved in all of the animals* Carpenter has shown that lesions of this structure are not essential to the production of torticollis Because lesions confined to the brachium conjunctivum before it becomes embedded in the reticular formation do not result in torticollis it may be that destruction of the brachium conjunctivum at its decussation is not essential

Vascular Response to Fracture of Tibia in the Rat. James B Wray *and Clifford J Lynch*[4] *(Bowman Gray School of* Medicine) found that a measurable enlargement of the local vascular bed of the rat occurs after a closed fracture of

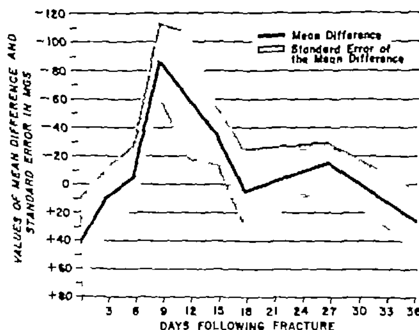


Fig. 180.—Curve showing rise and fall of vascular response after fracture of tibia in rat. Values of mean differences in milligrams are plotted against number of days after fracture and are noted as solid black line. Stippled band represents range of standard error of mean differences. (Courtesy of Wray J B and Lynch, C. J : J Bone & Joint Surg 41 A:1143-1148 September 1959)

the tibia. This process reaches a peak at 9 days (Fig 180) then gradually subsides to control levels with union of the fracture Other writers have used the words "hyperemia or "inflammation in describing the vascular phenomena associated with fracture The changes observed by the authors might more exactly be described by the word hyperplasia

(4) J Bone & Joint Surg 41 A 1143-1148 September 1959

to distinguish them from the transitory hyperemia noted after application of external heat to a part The changes seem to arise from the fixed enlargement of existing vessels and from the formation of new channels by capillary budding Though no specific effort was made to localize the origin of the enlarging vascular system preliminary observations suggest that the vessels of the periosteum and surrounding soft tissues play the predominant role Conversely the ability of the capillary bed to proliferate has been well documented and almost all writers on the subject of fracture histology recognize pronounced capillary proliferation in the fracture callus

In rats with fractures identical to those in the authors study it was noted that cellular proliferation in the periosteum reached a peak at 10-12 days after fracture This closely approximated the peak of the vascular response that the authors demonstrated and suggests that a coordinated effort between vascular proliferation and osteogenic cell proliferation occurs In this regard several workers have noted primary bone in close approximation to capillary buds

Certain limitations were encountered in the technic used by the authors. Complete filling of the capillary bed is probably not feasible Knisely has suggested that submaximal filling is commonest in vessels of 150 μ in diameter or less. Conversely many capillaries are probably preserved in each specimen Despite the viscosity of the plastic material, vessels down to 8 μ in size have been demonstrated in human specimens

Some variation in the completeness of injection was noted when separate animals were compared However when the body weight of each animal in the control series was compared with the weight of the plastic casts of its hind limbs, no significant correlation could be found

Variability in injection mass between paired limbs was minimized by cannulating the aorta above the iliac bifurcation

Effect of Arteriovenous Fistulas on Vascular Pattern of Femora of Immature Dogs Microangiographic Study Patrick J Kelly Joseph M Janes and Lowell F A Peterson[5] (Mayo Clinic and Found) established an arteriovenous fistula in 1 hind limb of 16 immature dogs Increased length of

(5) J Bone & Joint Surg 41 A 1101 1108, September 1959

the femur occurred in each hind limb in which a successful fistula was found The femur on the side of the fistula was lengthened in all 12 dogs with successful fistula and the tibia on the same side was lengthened in 9 of these 12 dogs Surface temperature of the femur in all of the 12 dogs was increased 1 month after surgical formation of the arteriovenous fistula and 1 month before the animals were killed

Gross arteriograms in addition to the macroangiograms were made with the dogs supine. Inflow of micropaque sus

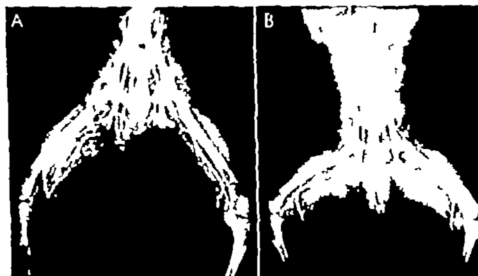


Fig. 181 —Gross arteriograms of hind limbs of dog at time of death. *A* pronounced vascularity evident in soft tissues on side of fistula on comparison with control side. *B* In this animal, fistula failed to function and there is no apparent difference in vascularity of soft tissues between right and left hind limbs. (Courtesy of Kelly P J., *et al.*: J Bone & Joint Surg. 41 A 1101 1108, September 1959)

pension into both hind limbs was equal Figure 181 *A* shows a sucessful fistula and *B* shows the vessels in the limb in which the arteriovenous fistula had closed off about 2 months after the surgical formation

Consistent and constant changes were noted by micro angiography in the femora of 12 dogs on the side of the suc cessful fistula. There was hypervascularity of the small vessels including capillaries of the medullary portion of the femur and increased cortical and periosteal blood supply particularly in the posterior distal half of the femur and in the region of the distal femoral epiphysis In some animals individual vessels were somewhat dilated. Hypervascularity indicates the presence of more filled vessels when specimens of the femur from the fistula side are compared with



Fig 182 (left) —Microangiogram of section (1 mm. thick) from head of femur near epiphysis on side of arteriovenous fistula, showing increased filling of vessels reduced from ×30

Fig. 183 (right) —Microangiogram of section of femoral head from control side in same dog This section was in same plane as Figure 182 and was obtained from comparable area of femoral head near epiphysis; reduced from ×30

(Courtesy of Kelly P J *et al* J Bone & Joint Surg. 41 A 1101 1108 September 1959)

similarly located specimens of femur from the other or control side. This was especially evident when vessels in the femoral head near the epiphysis on the side of the arteriovenous fistula were compared with those on the control side (Figs 182 and 183) Besides hypervascularity there was also a tendency to arborization of the small vessels

The findings from the microangiograms and temperature studies indicate an increased blood supply in the femur at least.

Experimental "Senile" Osteoporosis J F McClendon and J Gershon Cohen[6] (Albert Einstein Med Center) produced senile osteoporosis in rats by a diet low in calcium that was started during the early phases of life. This type of osteoporosis could not be produced by a diet low in calcium of short duration given only during the late phases of life.

Senile osteoporosis may be due to lowered output of sex hormones immobilization of the animal or low intake of calcium The authors have shown that though a diet low in calcium fed to weanling rats produced osteoporosis that was strikingly evident on x rays in 2 months the same diet fed to old rats did not produce notable changes in 6 months. A weanling rat has about 300 mg calcium in its whole body

(6) Am. J Roentgenol. 82 300 302, August, 1959

and an old rat over 5 000 mg Daily loss of 3 mg would make the weanling rat calcium free in 100 days whereas it would take 4½ years, or more than a rat s lifetime to do the same to an old rat

Henneman and Wallach have reviewed data on their own and Albright s patients with senile osteoporosis who were treated with sex hormones for 1-20 years Though progress of osteoporosis was arrested there was no x ray evidence that lost bone tissue was replaced

Though protein bone matrix and calcium phosphate are lost in osteoporosis adding calcium free protein to the diet will not prevent the development of osteoporosis in young rats. Calcium and vitamin C are necessary to hold the protein bone matrix in place All of the rickets producing diets that have been widely used are high in calcium content. The fleeting appearance of a small amount of osteoid in rickets due to low calcium may be explained by the temporary presence of calcium ions in the metaphysis while the calcium is leaving the body Possibly there might be some sex difference in this respect but we have never noted any

Not only are hormones and vitamins necessary to prevent or cure osteoporosis but calcium is also necessary along with adequate duration of treatment as measured in large fractions of the life span Thus the osteoporosis that the clinician and roentgenologist encounter in the later decades of life probably has its origin earlier and the low intake of calcium has had a cumulative effect over a long period

Study of Revascularization of Autogenous Cortical Bone Grafts in Rabbit Using Radiophosphorus Albert B Ferguson Jr Patrick G Laing Mary Grebner and Laverne Madancy[7] (Univ of Pittsburgh) performed radiophosphorus (P^{32}) pickup studies on over 250 bone grafts in rabbits The grafts were cut from the subcutaneous cortical surface of the upper tibial metaphyses and were replaced in the same defect on the same side Some grafts were replaced at once Others were cut into small segments before being replaced Animals were given P^{32} intravenously and killed 90 minutes later in groups at weekly intervals for 1 month After 4 weeks all grafts were well revascularized and incorporated into the host bone At autopsy grafts were removed in two halves one half without host bone for P^{32} assaying

(7) A.M.A. Arch. Surg 78 551 555 April, 1959

and the other half with adjacent host bone for histologic study As shown in previous studies radiophosphorus pick up methods offer advantages over histologic studies in comparing and contrasting the fate of various types of bone grafts This is probably true only if the interval between injection of the radiophosphorus and biopsy of the graft is short i e about 90 minutes

Results of this study suggested that other things being equal autogenous bone grafts transferred with their periosteum showed delay in early revascularization as compared with autogenous grafts without periosteum It is possible that the periosteum acts as a fibrous tissue barrier to surface invasion of host blood vessels

Solid and chopped bone grafts cut with an osteotome showed higher pickup than those cut with a rapidly rotating saw in the 1st week This difference was less pronounced in the 2d and 3d weeks A tendency was noticed for the saw-cut grafts to show the higher pickup in the 4th week. The delay in revascularization in the saw-cut grafts could be due to burning of host and graft bone by the saw blade. The necrotic bone resulting might excite a more marked host reaction and could account for the later tendency of saw-cut grafts to show greater vascularity

The chopped autogenous grafts showed more rapid revascularization than did the solid ones in the 1st week. This difference disappeared between the 2d and 3d week and reappeared to a less pronounced degree in the 4th week. It is believed that the early high rate of pickup was a reflection of the larger surface area exposed to revascularization in the chopped grafts

Influence of Splenectomy on Induction of Osteogenic Sarcoma in Rabbits Subsequent Report is presented by Joseph M Janes J F Herrick and George M Higgins[8] Osteogenic sarcoma may be produced in rabbits by intravenous injection of zinc beryllium silicate In an earlier study it was found that preliminary splenectomy increased tumor production from 50% to 100% In another group of 19 rabbits each animal was splenectomized then given 5 ml of 1% zinc beryllium silicate intravenously once a week for 10 weeks One or more osteogenic sarcomas developed in 12 rabbits. In 7 medullary sclerosis" developed—a condition

(8) Proc. Staff Meet. Mayo Clin. 34 47-49 Jan. 21 1959

the authors have come to recognize as prognostic of beryllium induced osteogenic sarcoma These 7 animals died or were killed before sufficient time had elapsed for production of tumors The results corroborate the previous finding that preliminary splenectomy will increase tumor formation to 100%

The initial reaction within the spleen to injection of beryllium is cellular hyperplasia, with pronounced increase in vascularity After this stage, the organ usually becomes atrophic and bone tumors develop When the spleen fails to atrophy as occasionally happens for reasons not clear, tumors fail to develop in the long bones These observations—that tumors arise when the spleen becomes atrophic, and do not appear in presence of a functional spleen—suggest that the spleen may have a protective influence. This deduction is sustained and further emphasized by the proof that splenectomy preceding beryllium injections permitted tumorigenesis in all of the animals.

Polyurethane Polymer, Its Use in Osseous Lesions Experimental Study Polyurethane foam a plastic substance of high molecular weight is composed of a catalyst and a polymer which when mixed, react to liberate CO_2. The CO_2 permeates the mixture producing a spongelike compound When used for fixation of bone the mixture is applied between the osseous surfaces to be bonded where it rapidly hardens into a foamy white porous, immobilizing agent. Its adhesive properties are decreased in the presence of excess blood or moisture so its use may be restricted to anatomic regions where adequate hemostasis is possible

Sufficient fixation for wound closure occurs in 20-30 minutes Complete hardening requires 18-24 hours during which, when the substance is applied to extremity fractures it is advisable to immobilize the limb After the 18-24 hour curing time the torsional stability of the bonded area is such that weight bearing may be initiated.

Joseph E. Salvatore and Michael P Mandarino* (Hahnemann Hosp Philadelphia) used polyurethane foam in 23 operations on dogs. In 11 animals oblique femoral fractures were created with an osteotome The foam was placed between the fragments and allowed to harden In 9 animals by the criteria of fracture site stability absence of infec

(*) Ann Surg 149 10 109 January 1959

tion, apparent absence of pain and x ray evidence of bony union results were excellent. Weight bearing was well tolerated within 24 hours The 2 failures probably resulted from insufficient hemostasis

In 2 of 3 instances results of dorsal spinal fusion were excellent Polyurethane foam was placed about the prepared fusion site. Casting was not necessary In 1 instance wound infection occurred and within 2 weeks the plastic material sloughed out

In 3 dogs cystic areas 1.2 cm in diameter were created in the femoral shaft and filled with polyurethane foam In all 3 weight bearing and complete healing occurred without incident. Use of polyurethane foam for hip fractures mandibular defects and cranial defects was unsatisfactory primarily because of poor hemostasis

Histologic sections taken from regions of plastic implantation revealed osteoblastic activity invading the lacuna like framework of the foam There was progressive replacement of plastic by new bone Polyurethane foam in vivo is slowly absorbed so that only one fourth to one sixth of the original volume remains 12 months after implantation.

Polyurethan Polymer—Its Use in Fractured and Diseased Bones was studied by Michael P Mandarino and Joseph E. Salvatore[1] (Hahnemann Med College) Attempts have been made to obtain a suitable synthetic or plastic that can be poured in liquid form set within a reasonable length of time and have the qualities of strength osteogenesis nontoxicity cohesiveness and ease of handling required during surgery Of several possible materials which approach ideal requirements rigid polyurethan foam (ostamer) was used by the authors

For the purpose of producing a dense rigid cellular foam for orthopedic use a polymer is prepared by reacting a trihydroxy resin with an excess of diisocyanate This polymer is mixed with a catalyst at the time of operation. Carbon dioxide is liberated producing a spongelike compound with 7 10% cellular structure The polymer and catalyst are liquids and when they are mixed in a 1 4 ratio the resultant volume is about 3 times the original No heat is liberated The polymer bonds to the surfaces to be held bridged, filled or strengthened. Ostamer in and during its formation becomes

(1) Am. J Surg 97:442-446 April, 1959

an intimate part of the bone It is this property that differentiates it from a glue adhesive or common cement type of bonding

To date there has been no evidence of toxicity of Ostamer to dogs, rats or guinea pigs and the material elicits little or no tissue response at the site of implantation Polyurethan was applied to surgically created defects in the radii and femora of dogs which were followed radiologically and histologically Polyurethan appeared to have satisfied requirements for fixation of the fragments without inhibiting osteogenesis

Use of ostamer is best restricted to anatomic regions where adequate hemostasis by tourniquet or other established technic may be secured Sufficient fixation for wound closure occurs in 20-30 minutes Complete hardening requires 18-24 hours during which a posterior splint might be used After 24-48 hours curing time the stability of the bonded area is such that weight bearing may be initiated The chemical remains radiolucent.

Ostamer was used for bone fixation in 6 patients One acute fracture of the tibia 3 nonunions (2 tibial and 1 supracondylar femoral) and 2 pathologic fractures of the femur were united by ostamer Results were quite satisfactory in all of the cases

► [This is a new method being expounded for the treatment of fractures At present, it has been investigated by the two authors mainly and, although they have performed animal experimentations, there is some doubt as to whether the new bone grows through the plastic substance and unites the fracture or whether this remains a foreign body More experimentations need to be carried out before this can be used as another one of the items in the armamentarium for the treatment of fractures

Needless to say one still is confronted with the probability or possibility that the fracture site might become infected and if, as the authors have stated, the plastic substance forms such a bond with bone, the treatment of infection may prove to be quite a problem. It is well recognized that a foreign body is something that must be removed before infection can be controlled. I would not like to advocate this method of treatment as yet but I am keeping an eye on its progress.

Other investigators have not yet been able to confirm the authors statement that "ostamer" is an inert substance or that bone grows through this foreign material to effect a union of the fracture.—Ed.]

Use of Plaster of Paris to Fill Large Defects in Bone Preliminary Report is presented by Leonard F Peltier[3] (Univ of Kansas) Implantation of plaster of paris into bone or soft tissue does not produce a foreign body reaction characterized

(3) Am. J Surg 97 311 315 March, 1959

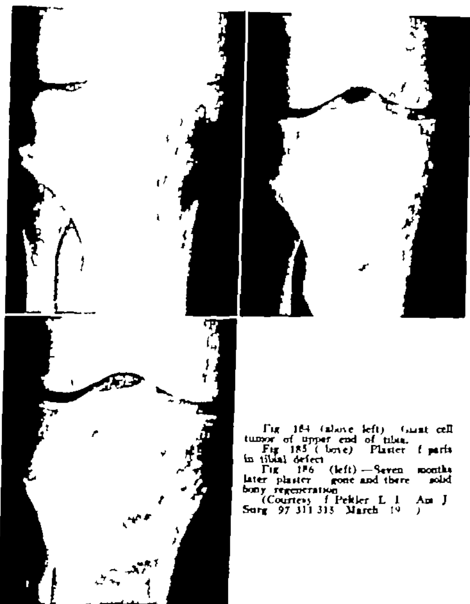


Fig 184 (above left) Giant cell tumor of upper end of tibia.
Fig 185 (above) Plaster of paris in tibial defect
Fig 186 (left) —Seven months later plaster gone and there solid bony regeneration
(Courtesy of Peltier L F Am J Surg 97 311 315 March 19)

by formation of foreign body giant cells or infiltration of polymorphonuclear leukocytes or lymphocytes The material is accepted well by the tissue Plaster of paris by itself does not stimulate bone formation New bone is formed only when periosteum or bone is also present. Plaster of paris in a wound does not inhibit bone formation It is regularly absorbed and removed from the site of implantation regardless of whether new bone is formed Infection in wounds containing plaster of paris is not complicated by sequestration of the

plaster It drains out with the pus or is absorbed None is retained at the site of implantation

The author used plaster of paris to fill some defects in human bone. Five patients were selected primarily because they presented large defects and were challenging problems in reconstructive surgery The immediate results encouraged the author to publish his preliminary report to promote interest in the possibilities of this procedure

In initial experiments with dogs an immediate postoperative rise in serum calcium levels was noted Such a rise could not be demonstrated in any of the 5 patients Although plaster of paris is absorbed quickly if the patient has adequate fluid intake and output and is mobilized rapidly hypercalcemia and its attendant complications do not appear to be a hazard The use of the plaster of paris did not adversely affect the healing in any of these defects It appears to have contributed significantly to rapid healing in all of them

The outstanding feature in these cases is the speed with which the plaster is removed from the site of implantation and new bone is formed in the defect (Figs 184-186) Progress can be seen in weeks in contrast to the long periods usually involved when autogenous or homogenous bone grafts or other types of substitutes are used in a similar manner

► [The various methods used in the past to attempt to substitute for bone grafts for filling bone defects are many and varied. The use of plaster-of paris for filling these defects is most interesting and is obviously as yet on a more or less experimental basis and not to be accepted as the method of choice in the treatment of these conditions and certainly not to be accepted when bone for a bone grafting procedure is available. The observations in this article are, however most interesting and were recorded for this purpose.—Ed]

Growth Studies of Transplanted Epiphyses Bromley S Freeman[3] (Baylor Univ) successfully transplanted autogenous epiphysial cartilages with retention of the original growth capacity The distal half of the proximal middle and distal phalanges of the right 2d toe were transplanted by pedicle in two stages over a month to the base of the proximal phalanx of the right thumb of a child aged 20 months X rays 6 years after surgery showed identical growth rates of the width contour and length of the shaft and size of the epiphyses in the phalanges of the undisturbed left 2d toe and those transplanted (Figs 187 189)

There are many technical difficulties in maintaining a via

(3) Plast & Reconstruct. Surg. 3 554-588, June 1959

ble transplant with sufficient vascularity for its maturation rate to remain unchanged Growth of epiphysial transplants has been reported by Barr and co-workers Transplants

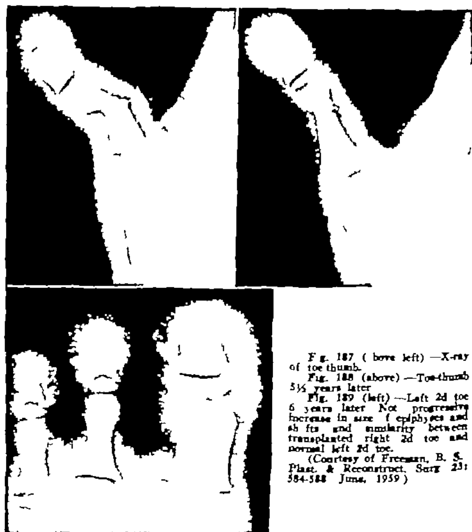


Fig. 187 (above left) —X-ray of toe thumb.

Fig. 188 (above) —Toe-thumb 5½ years later

Fig. 189 (left) —Left 2d toe 6 years later Not progressive increase in size of epiphyses and shafts and similarity between transplanted right 2d toe and normal left 2d toe.

(Courtesy of Freeman, B. S. Plast. & Reconstruct. Surg 23: 584-588 June, 1959)

that have not grown must be regarded as individual technical failures they are not due to the specific inability of autogenous epiphysial plate grafts to grow The transplant will live and grow on a heightened supply of oxygen whereas a moderately decreased supply barely adequate to maintain viability may permanently arrest or modify growth In Freeman's patient the pedicle or temporary shunt maintained the oxygenation and in the successful implants of Barr *et al* their precise nontraumatic technic was presumably adequate

Method of Using Sections of Bone Prepared for Microangiography for Subsequent Histologic Study was developed by Patrick J Kelly Lowell F A Peterson and Joseph M Janes[4] (Mayo Clinic)

METHOD—A stock solution of 20% paralodion is made up with a solution that is 50% ether and 50% absolute alcohol In addition, solutions of paralodion of 2 4 6 8 and 10% are made by adding appropriate amounts of the ether alcohol solution to the 20% solution of paralodion Infiltration of the specimens removed from the ether alcohol mixture is accomplished by immersion for 24 hours in 2 4 6 8 and 10% solutions of paralodion in turn. The bone specimens are immersed in 20% paralodion for 2 days in paper cups covered by a glass jar Hardening is accomplished by removing the paper cups from the specimens and exposing the blocks to chloroform for 5 20 minutes. The trimmed blocks are glued to pine blocks with 8% solution of paralodion. The blocks are stored in 80% absolute alcohol Serial sections varying in thickness from 10 to 60 µ are cut from the block with a heavy-duty sliding microtome The sections are stained with hematoxylin counterstained with eosin and examined under the microscope.

Use of a combination of plain and stereoscopic microangiography with histologic study of the same section permits three-dimensional study The thin histologic section alone presents an incomplete picture of blood vessels in bone but the histologic methods allow confirmation of the findings obtained by soft radiation technics

Sections prepared by the histologic method described give excellent detail when studied under the microscope Their one fault is the loss of some cellular detail when reproduced by photomicrography Injection of the specimen with the micropaque gelatin mixture spots or identifies vessels and preserves their shape

Dynamics of Bone Healing and Its Effect on Skeletal System in Vivo Using Strontium-85 and Calcium-47 H Koenig and John H Heller[5] (New England Inst for Med. Res) found that Sr^{85} faithfully mimics calcium as an index of the early processes that follow bone fractures Fractures were induced manually in the tibia in rats at which time 10 µc Sr^{85} was given subcutaneously then 1 µc was given daily thereafter Radioactive uptake was measured daily 30 minutes after injection of the isotope Control rats without fracture were given the same dose of Sr^{85} and radioactive uptake was measured as in those with fractures

(4) Proc. Staff Meet. Mayo Clin. 34 274-283 May 27, 1959
(5) Surg., Gynec. & Obst. 109 351-354 September 1959

Immediately after fracture was induced there was loss of mineral at the fracture site and comparable loss of mineral from other bones in the skeletal system at the same time (Fig 190) From day 3 through day 8 remineralization occurred not only at the fracture site but in other bones A secondary drop in mineralization was observed in all rats at the fracture site and in the rest of the skeleton starting at about day 8. Later remineralization at the fracture site again occurred, but loss of mineral from other parts of the bony skeleton persisted until mineral uptake at the fracture site returned to normal range

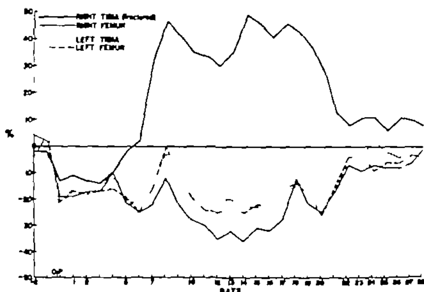


Fig 190.—Rate of Sr^{85} deposit or loss in bones of rats with fractured tibias, compared with corresponding bones in rats without lesions. Each curve represents mean value of 20 rats measured daily (Courtesy of Koenig H., and Heller J H. Surg Gynec. & Obst 109 351 354 September 1959)

The demineralization of unaffected bones in an animal with a fracture suggests a humoral control mechanism If this assumption is correct it is probable that the initial period of remineralization is also due to a humoral factor It might be postulated that this latter factor is exhausted after day 8 to account for the inevitable loss of mineral from both fracture site and normal bone Bone adjacent to the fracture consistently lost more mineral than other bones of the skeleton, suggesting that mechanisms other than simple humoral ones may operate

Effect of Hyperoxia on Bone Resorption in Tissue Cul

ture was studied by Paul Goldhaber[6] (Harvard Univ.). Tissue cultures of young mouse calvaria subjected to 95% oxygen and 5% carbon dioxide in the gas phase routinely exhibited rapid bone resorption, often recognizable as early as 1 day after cultivation. Initially the resorption process was most prominent in the frontal bone, near the heavily calcified area adjacent to the median suture. By the 5th day of cultivation the bone in the region of the frontal suture was almost completely resorbed, and the process had spread laterally to involve most of the frontal bone. The parietal bone was also affected. The earliest sign of activity in this area was the appearance of small "holes" within the bone. These gradually enlarged and coalesced during the next several days until typical scalloped areas of resorption were readily visible throughout the explant.

Observations with time-lapse cinematography (×100 magnification) revealed marked cellular activity, particularly of macrophages within the resorbing explants. Although typical osteoclasts were not readily distinguishable in the living cultures, histologic examination revealed their presence within 3 days after cultivation. By the 6th day the resorptive process had slowed considerably and the explant appeared more dense and opaque. In older cultures the most striking histologic difference between control fragments from ungassed cultures or those gassed with 95% air and 5% carbon dioxide (neither procedure produces bone resorption) and oxygenated cultures was the sparsity of cells and progressive degeneration in the former explants. By comparison, the latter oxygenated explants showed an increase of healthy viable cells. Explants exposed to high concentrations of oxygen maintained the added capacity to form new bone after the initially rapid bone resorption had ceased. By 11 days distinct areas of newly formed osteoid were found within the explants of many oxygenated cultures.

This effect of hyperoxia may be similar to that of parathyroid hormone, both agents modifying the metabolic pathway of bone-resorbing cells or their precursors and resulting in local accumulation of substances required for bone resorption.

Xeroroentgenography: Evaluation of Its Use in Diseases of Bone and Joints of Extremities is presented by Crawford

(6) A.M.A. Arch. Path. 66:631-641, November, 1958.



Fig 191 —Difference in pattern of tumor bone and irritative new bone formation at pper margin of osteogenic sarcoma is interesting in xeroroentgenogram. (Exposure focus-skin distance 40 in, Par Speed intensifying screens, Bucky, 50 ma., 60 kvp.) (Courtesy of Campbell, C. J., et l J Bone & Joint Surg 41 A 271 277 March, 1959)

J Campbell John F Roach and Munir Jabbur[7] (Albany Med. College) In xeroroentgenography roentgen images are recorded with a standard roentgenographic camera by a photoelectric process rather than the photochemical process used in conventional roentgenography An electrostatic im

(7) J Bon & Joint Surg 41 A 271 277 M rch, 1959

age of the size shape and radiodensity of an interposed object is produced on a xeroplate which is a metallic plate coated with a semiconductor such as selenium The image is made visible by placing finely divided powder granules on the charged pattern of the xeroplate The processing unit is small and can be placed on a wheeled stretcher so that it can be moved easily This method requires no x ray film or darkroom the whole procedure usually takes less than 50 seconds

Xeroroentgenograms and conventional roentgenograms were made of the involved bone or joint in 100 patients with pain or disability in an extremity The xeroroentgenograms were photographed using 35-mm type F Kodachrome film and the photographs were enlarged The conventional roentgenograms were reduced so that the roentgen images by both technics were identical in size Xeroroentgenograms conventional roentgenograms made of pathologic specimens and microscopic slides were obtained in some cases Fine definition and contrast gradation was greater in the xeroroentgenogram than in the conventional roentgenogram in studies of bone and soft tissue

Radiodense and radiolucent portions of the image were shown in the xeroroentgenogram Injection of air into a joint further enhanced visualization of soft tissues Margins of bones that were extremely osteoporotic or sclerotic were more clearly defined than in conventional roentgenograms New bone formation in the soft tissue (Fig 191) was more apparent in the xeroroentgenogram

Experimental Study of Transplantation of Preserved Homogenous Articular Cartilage in Dogs was carried out by Thomas Horwitz Robert E Morrow and Thomas R. Springer[8] (Indianapolis Gen l Hosp)

Cartilage caps including a thin layer of subchondral bone were fashioned from the femoral heads of recently slain dogs and preserved for variable periods after which they were transplanted over the denuded femoral heads of living dogs In a few instances segmental defects were created in the articular surface of knee joints and these were filled with segments of preserved homogenous cartilage of similar contour The animals were killed 8 days 2 4 6 9 and 12 weeks after surgery

The surgical approach that was best adapted to the hip

(8) Surg Gynec & Obst. 109 67 2 July 1959

joint of a dog was one just lateral to the adductor muscles and medial to the femoral vessels in which interval the femoral head is easily palpated with the hind limb in external rotation The approach to the knee joint was by medial parapatellar incision.

Preservation of the cartilage transplants followed the technic of LoGrippo and co-workers who simplified the problem of source of human tissues for preservation by their method of collecting and preserving tissues from cadavers The femoral head or distal femoral articular surface was resected without sterile precautions and placed in tincture of Merthiolate (1 4000) for 24-48 hours At some time during this interval the specimens were removed from this solution under sterile precautions and their cancellous content reamed out with an electric bur leaving a thin subchondral layer of bone. The cartilage specimens were sterilized, cultures were made and the specimens were finally transferred to an empty container for deep freezing

The articular cartilage graft was found to manifest degenerative changes in its cells and matrix early in the course of its preservation by chemical sterilization and freezing before use as a transplant. Early (8 days) after transplantation the cartilage graft was not yet secured to the host bone. The cartilage cells stained poorly and the subchondral bone was dead *In 2 weeks an intense inflammatory cellular response* appeared between the cartilage graft and the host tissues In 4 weeks this inflammatory response was still striking but diminishing and it was mingled with a fibrous tissue response arising from the marrow spaces of the host bone This was replaced in the 6 weeks specimen by pronounced fibroplasia between the cartilage bone transplant and the host bone and during this phase the degenerating cartilage cap became well affixed to the host This same response was present at 9 weeks with further degeneration of the transplanted cartilage surface By 12 weeks the dead cartilage bone transplant had undergone considerable dissolution

Influence of Experimental Arteriovenous Fistula on Healing of Fractures and on Blood Flow Distal to Fistula. John N Henrie Emer W Johnson Jr Khalil G Wakim and Alan L. Orvis[9] (Mayo Clinic and Found) did experimental stud

(9) Surg Gynec. & Obst 108 591 599 May 1959

ies to determine the effects of an arteriovenous fistula on healing of bone and to investigate the circulation in the limb distal to the induced fistula. An arteriovenous fistula was established in the left external iliac vessels of 25 adult dogs in 21 in conjunction with partial resection of each fibula or with fractures of the left or bilateral femurs. The right legs served as controls.

Nine animals had partial resection of the fibula and were killed at various intervals for study of bone regeneration but none was found. Of the other 12 animals the fractures were checked periodically by x-ray and all were killed as soon as healing became evident. Microscopically, roentgenologically and clinically, no difference in the rate of fracture healing could be demonstrated between the limb with normal circulation and the one with the arteriovenous fistula.

Circulation in the extremity was studied by recording temperatures, measuring arterial blood flow, determining the oxygen content of venous blood and by arteriography. Injection and monitoring of radioactive iodinated human serum albumin revealed a significant time lag in attainment of equilibrium on the side with the fistula as compared with the control side. The arterial blood supply was decreased in the limb distal to the arteriovenous fistula. Venous stasis was present distal to the fistula and oxygen content of the venous blood was reduced. Retrograde flow or arterialization of venous blood in the limb distal to the fistula was not demonstrated.

Use of Muscle Pedicle Cancellous Bone Grafts. In experimental studies on dogs Joe B. Davis[1] (Portland, Ore.) observed that cancellous bone grafts remain viable when attached to a pedicle derived from muscle fibers. Cancellous bone transferred from one muscle belly to another also remained viable.

Davis first used the muscle pedicle cancellous bone graft in hip fusions in man. The essential features of the procedure were (1) preparation of the graft from the anterior iliac crest and the pedicle from the tensor fascia femoris muscle, (2) transfer of the graft to the hip, (3) interarticular arthrodesis and (4) intertrochanteric osteotomy.

In arthrodesis of the shoulder the graft is prepared from the entire acromion and its pedicle from the deltoid muscle

(1) South. M. J. 5: 429, January 1959.

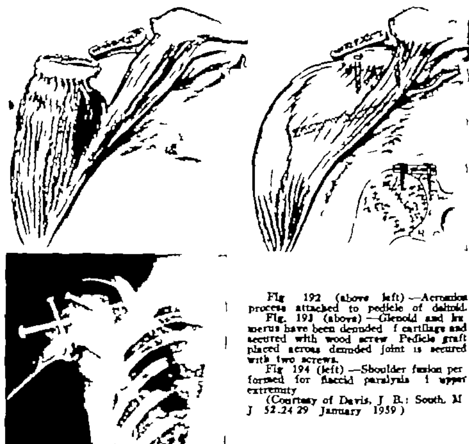


Fig 192 (above left) —Acromion process attached to pedicle of deltoid.
Fig. 193 (above) —Glenoid and humerus have been denuded of cartilage and secured with wood screw Pedicle graft placed across denuded joint is secured with two screws.
Fig 194 (left) —Shoulder fusion performed for flaccid paralysis of upper extremity
(Courtesy of Davis, J B.: South. M J 52:24 29 January 1959)

(Fig 192) The glenoid and humerus are denuded of articulating cartilage and held in contact by a wood screw The roughened graft is then placed across the joint and secured by two bone screws (Figs 193 and 194)

In sacroiliac fusion the graft is cut from the posterior crest of the ilium with a pedicle from a portion of the gluteus maximus

The graft in triple arthrodesis is a portion of the os calcis with the short toe extensor muscle attached A standard intra articular triple arthrodesis is done after which the graft is attached in the area of the denuded tarsal sinus

Davis performed 20 lumbosacral fusions using muscle pedicle cancellous bone grafts The graft was cut from the posterior crest of the ilium, and the pedicle was taken from the sacrospinalis muscle. Avoidance of tension on the blood supply of the pedicle was extremely difficult When tension could not be avoided the blood supply to a portion of the

pedicle was lost The operative sites in 2 patients became infected, and sequestrations were necessary Nevertheless, in the areas in which the pedicle was viable, the graft remained alive despite infection

Stimulation of Bone Growth by Internal Heating Victor Richards and Raymond Stofer[2] (Stanford Univ) point out that temperature and oxygen tension are probably the two most important physical variables affecting living cells Physiologic alteration of either or both of these variables might influence the rate of bone growth. Alteration of bone

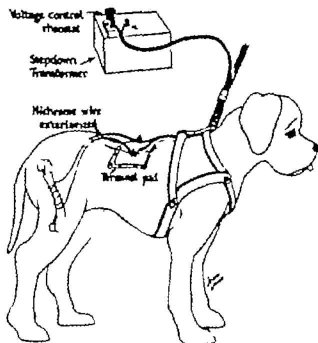


Fig. 195 —Experimental design for unilateral bone heating. (Courtesy of Richards, V., and Stofer R. Surgery 46 84 96, July 1959)

growth must be unilateral and localized to be of clinical significance The possible experimental approaches for unilateral alteration of the rate of bone growth would in theory include augmentation of blood flow unilaterally increase of tissue oxygen tension unilaterally localized heating of the epiphyses unilaterally application of unilateral distracting force to the epiphysis and unilateral stimulation of the nerve to a growing bone

The authors developed a method for internal heating of bone that permitted the experimental animal to run freely in

(2) Surgery 46 84-96, July 1959

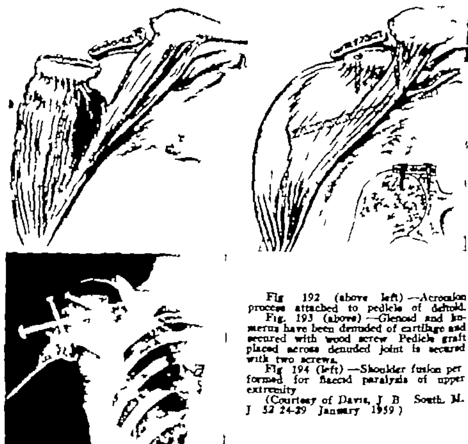


Fig 192 (above left) —Acromion process attached to pedicle of deltoid.
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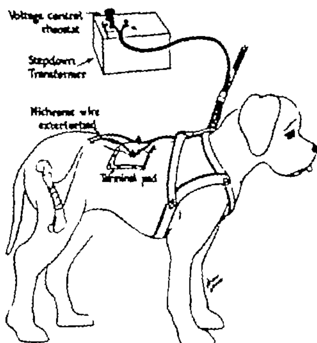


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The authors developed a method for internal heating of bone that permitted the experimental animal to run freely in

(2) Surgery 46 84-94 July 1939.

the cage (Fig 195) Local bone temperature and local bone blood supply were increased by this procedure but the animal remained well and afebrile. Bone temperature was raised between 1 and 2 C Bone growth was stimulated in rats and dogs In all instances length was increased In rats average increase in the length of the femur of the experimental limb was 6-7% The duration of heating varied from 24 to 94 hours In dogs average increase in the length of the heated femur was 2.2% after a heating period of 96 hours Dry bone weight in the rat and dog increased to even greater degree, about 20%, indicating concentric as well as longitudinal growth

Initial observations suggest that fractures may heal more rapidly by application of the same local heating method

The major practical complication has been the occasional fracture of the heated bone in the rat This might be due to the rigid wire cutting against the expanding shaft of the bone Nonunion did not occur

Arteriographic Picture of Metastatic Bone Disease Robert Schobinger[3] (Roswell Park Mem l Inst Buffalo) observes that osteolytic bone metastases are angiographically characterized by the presence of abnormal vessels Vessels may be visualized in areas that normally fail to exhibit distinct vascular channels on arteriographic examination This finding is demonstrable in both arterial and venous phases of the arteriogram but it is more evident during the period of arterial filling A variable number of usually small arteries which often appear to remain of equal caliber over some distance and sometimes appear tortuous may be seen to converge on the area of metastatic bone destruction It is sometimes possible to follow the course of the vessels only to the periosteum but in more advanced destructive processes they may be identified within the bone itself

These observations may indicate new vessel formation or they may represent increased use of pre-existing vascular channels The latter assumption may well apply to the augmented venous network occasionally observed in the area of neoplastic deposits since by intraosseous venography many small veins connecting the bone into which injection is made at various levels with the systemic venous circulation can be demonstrated under normal conditions

(3) Cancer 11 1264 1268 Nov Dec 1958

Depending on the location and size of the metastasis the contour of an entire neoplastic process may be clearly outlined by arteriography. This feature can often be better appreciated during the venous phase and appears to be related to the amount of pathologic vascularity.

Intra arterial injection of a radiopaque substance (red lead turpentine mixture) into surgical specimens is apt to reveal certain details that escape visualization during clinical arteriography. Almost all the metastatic lesion of the iliac region appears to draw its main blood supply from one large vessel originating from the common femoral artery. The arterial channel appears to maintain a relatively equal diameter for some distance and the entire lesion shows angiographic architecture typical of malignant processes.

Demonstration of circulation within normal bone is not as yet possible with conventional arteriographic methods. Apparently bone possesses its own circulatory system. Hence the fact that vessels are demonstrable in areas in which arteriography fails to reveal them under normal conditions must be considered an indication of the presence of a disease process.

► [The study of bone tumors by arteriographic methods is in its infancy. One might be able to predict that the osteolytic lesions were naturally going to be more vascular whereas the osteosclerotic lesions were to show the opposite effect. This is not the important point of this paper. The important point is that it illustrates the fact that tumors can be studied by this method—not only metastatic, but primary malignancies as well. This may lead to methods of preoperative diagnosis and ultimately prove of value in the treatment of the patient. Needless to say these investigations are still in their infancy. Further advances should be looked for in this particular field of investigation.—Ed.]

MISCELLANEOUS

Fat Embolism in Chronic Alcoholism Control Study on Incidence of Fat Embolism. Among 40 patients with alcoholic fatty liver Matthew J G Lynch Stanley S Raphael and Thomas P Dixon[4] (Sudbury, Ont) found at autopsy pulmonary fat embolism in 31 (77 5%). In 14 of these the brain was examined and fat embolism was found in 12 (68 6%) whereas the 2 negative cases showed pronounced perivascular accumulation of fat laden scavenger cells a

(4) A.M.A. Arch Path 68 80 Jan 1959

finding which the authors have noted in all alcoholic fatty livers Of 19 patients with alcoholic cirrhosis 14 (73.7%) showed fat emboli in the lungs. In 9 such instances, the brains were available and fat embolism was found in 6 (66 6%) In most of the alcoholic group death was attributable to conditions not directly related to alcoholism However in certain instances the fat embolism appeared to have played a decisive role in the cause of death, whereas in others it may very well have formed a major contributory factor

The clinical picture of fat embolism in a patient is described

Man 30 alcoholic, during one of his bouts called at a doctor's office at 9 p.m., complaining of shortness of breath and "choking" of 2 hours duration. During the past 2 years he had similar attacks toward the end of the alcoholic episodes, but none had been as severe as this one. He was adamant that he had only 3 bottles of beer that evening Because the clinical findings were not definite and the doctor did not know the patient s background, morphine was given, ¼ gr The patient went to bed that night about midnight "in his usual inebriated state. At 1 a.m., his wife noted that he was breathing heavily He died a few hours later

Autopsy revealed grade 2 3 fatty infiltration of the liver and fat embolism in the lungs and brain. Alcoholic concentrations in specimens obtained were blood, 1 62 parts/1,000 urine, 3.66 parts/1 000 stomach contents, 2.36 parts/1 000 Death was believed to be due to respiratory failure occasioned by the combination of acute alcoholism fat embolism and morphine.

Sputum fat globule assays were performed in 51 patients hospitalized for alcoholic psychosis The sputum of 48 was positive for fat globules The number of fat globules was consistently proportionate to the severity of symptoms and signs and also paralleled the duration and severity of the alcoholic history The fat-globule count in the sputum dropped invariably as the clinical status improved. The size of the globules was roughly related to clinical severity The 2 cirrhotic patients of the group had strongly positive sputum

Of 268 consecutive autopsies 73 (27.2%) showed intravascular fat emboli However by merely stating that fat embolism was found to occur in 27.2% may give an entirely erroneous and unfavorable impression of the importance of fat embolism The degree of embolization is valuable even with the limitations as to precision inherent in the method.

Fat embolism in chronic alcoholism is not heavy or con

sistently present indeed as compared with trauma cases it is relatively light

► [Whereas this paper points out the relative high incidence of fat embolism in chronic alcoholism and its possibility as the cause of death in cases of chronic alcoholism and acute bouts of alcoholism in chronic alcoholics, the authors do state very specifically that the incidence of fat embolism is even higher in patients who succumb following injury. Of their group of autopsies performed they found that 93.75% of all trauma cases showed presence of fat emboli. This high percentage of fat embolism in trauma cases recalls to my mind the statement made many times by Dr H E. Robertson, who was a pathologist at the Mayo Clinic, that if one searched diligently enough in all patients who had suffered trauma, particularly broken bones and succumbed, 100% of these would show evidence of fat emboli. This does not mean that the fat emboli caused the patient's death necessarily and indeed the authors of this article point out the very significant fact that it is not the mere presence of the fat embolism that is important, but the degree to which the fat emboli are present. The fact that fat emboli may occur in a chronic alcoholic to a sufficient degree to cause death even without trauma may have some significance from a medicolegal standpoint.—Ed.]

Injuries from Power Lawn Mowers Some Roentgenographic Aspects. The increasing popularity of power lawn mowers is associated with an increasing number of serious

Power Lawn Mower Accidents, Chester County Hospital, 1957 58

Age	Sex	Type of Mower	Injury	Method of Injury
55	M.	Rotary	Debridement of medial side of arch of foot fracture of 5th metatarsal and cuboid	Ran over foot
15	M.	Unknown	Laceration of heel	Stepped in front of mower
25	M	Rotary	Puncture wound of ankle	Ran over wire piece flew into foot
21	M.	Rotary	Laceration of great toe	Ran over toe
12	M	Rotary	Amputation of great toe nail avulsion terminal tuft, toe	Unfamiliar with machine distracted, ran over foot
17	M	Rotary	Great toe nail and tissue torn	Foot in front of mower
50	M	Rotary	Laceration of tip of finger	Adjusting running motor
47	M	Rotary	Cut leg	Ran over sharp object
49	M	Rotary	Lacerated great toe	Ran over toe
50	M.	Unknown	Lacerated great toe	Ran over toe
30	M	Rotary	Lacerations, severed tendons, fractured toes	Backed up mower put foot in front, pushed mower forward
56	M	Rotary	Laceration of thumb	Assembling mower

(*Continued*)

Power Lawn Mower Accidents Chester County Hospital, 1957 58 (*cont*)

Age	Sex	Type of Mower	Injury	Method of Injury
72	M	Unknown	Avulsion, tip of finger	Reached into running mower
4½	F	Rotary	Contusions and abrasions of 3 fingers	Investigated unattended running mower
22	M	Reel	Cut dorsum hand	Cut on reel
25	F	Rotary	Cut ankle	Ran over spoon
42	M	Rotary	Cut knee	Broken wire in mower
39	M	Rotary	Lacerations, contusions finger	Repairing running mower
46	M	Rotary	Badly cut toes	Ran over foot
33	M	Rotary	Laceration, ball of foot toe	Stepped barefoot on blade of running mower
50	M	Rotary	Fractured nose, oral trauma, tooth injury	Lost control, fell on exhaust pipe
55	M	Reel	Laceration, fingers tendons	Reached into grass catcher, hand contacted reel
57	M	Rotary	Mangled and amputated fingers	Rode over bank, fell off seat
40	M	Rotary	Laceration finger	Cleaning grass from running mower
17	F	Rotary	Puncture wound, foot	Ran over wire
23	F	Rotary	Amputation, toes	Ran over foot
53	M	Rotary	Laceration, finger	Adjusting running mower
63	M	Rotary	Avulsion, fingers	Reached into running mower
28	F	Rotary	Lacerations puncture, leg	Ran over wire
45	F	Rotary	Laceration finger	Reached into running mower to remove grass
40	M	Unknown	Puncture, left ankle	Struck wire
29	M	Rotary	Laceration, shin fracture, tibia	Struck stone
15	M	Rotary	Laceration, hand	Sharpening blade
35	M	Rotary	Laceration, hand	Repairing motor while running
14	F	Rotary	Avulsion toes	Bare foot caught
14	M	Electric	Laceration, finger	Cleaning grass from running mower with brush
13	M	Reel	Laceration, finger	
18	M	Unknown	Laceration of toe	Ran over toe
40	F	Rotary	Contusions, laceration, leg	Struck stone
40	M	Rotary	Laceration, hand	Repairing mower (not running)

injuries to the operator and bystanders Robert N Byrne Louis S Bringhurst and J Gershon Cohen[5] (Chester County Hosp West Chester Pa) report that 40 power mower accidents were treated during the past year at their hospital in a community of about 15 000 This community is also served by another hospital that could probably record many more cases

Most power mower injuries involve the extremities principally the feet (table) However, wounds from flying objects may involve almost any part of the body Of the different types of power mowers the reel mower generally is considered relatively safe. The blades turn as a horizontal cylinder and loose objects they encounter are thrust toward the ground. The rotary mower is responsible for most injuries The blades rotate horizontally at high speed and with powerful cutting force on a vertical shaft. Any object thrust into the blades is cut horizontally Foreign bodies such as glass wood, rock wire or metal are picked up and thrown out of the mower and the operator or any person nearby is exposed to injury

The National Safety Council has made recommendations regarding safer construction of power mowers and it remains principally for the medical profession to publicize and emphasize the potential dangers

► [It is a well known fact that quite a number of injuries occur each year through the use of the rotary type of power mower particularly and it is the duty of the physician to call attention to the fact that these machines can cause serious damage. Likewise, we can help point out the means of prevention. *Is it not at the same time our duty as physicians to point out the means of prevention of tetanus following injuries of this type?* In years past, the medical profession accomplished eradication of smallpox and other diseases by emphasizing the importance of immunization of the public We have, however, been remiss in not emphasizing to the public the value of tetanus toxoid immunizations. Although the incidence of tetanus is low it would seem to me, in this age of mechanization and increasing incidences of trauma, that more publicity should be given to tetanus toxoid immunization. If such a program were carried out it not only would decrease the incidence of actual tetanus cases but would make the treatment of traumatic cases far simpler and remove the possibility of untoward antitoxin reactions —Ed.]

Parasternal Chondrodynia (Tietze's Syndrome) Neale Barnes and James Graham[6] (Springfield, Ill) report 4 cases of Tietze's syndrome. Only 9 other cases have been recorded in the American literature, but this small number ap

(5) GP 19 127 131 February 1959
(6) Ann. Int Med. 51 57 59 July 1959

POWER LAWN MOWER ACCIDENTS CHESTER COUNTY HOSPITAL, 1957 58 (*cont*)

Age	Sex	Type of Mower	Injury	Method of Injury
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4½	F	Rotary	Contusions and abrasions of 3 fingers	Investigated unattended running mower
22	M	Reel	Cut dorsum hand	Cut on reel
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18	M	Unknown	Laceration of toe	Ran over toe
40	F	Rotary	Contusions laceration, leg	Struck stone
40	M	Rotary	Laceration, hand	Repairing mower (not running)

causes including tear occurring with normal activity and 15.9% to direct injury without an open wound In the lower extremity, 40.5% were due to laceration 44 8% to excess stress and miscellaneous causes and 14.7% to direct injury without an open wound.

The flexors and extensors of the fingers plus the musculo tendinous cuff and biceps brachii represented 76% of the

TABLE 1—Anatomic Distribution of 1 014 Disruptions of Muscles and Tendons

Upper Extremity	Number	Lower Extremity	Number	Trunk	Number
Flexors of fingers	316	Quadriceps mechanism	54	Left hemidiaphragm	6
Extensors of fingers	134	Tendo achillis	22	Trapezius	
Musculotendinous cuff	182	Triceps surae	21	Rectus abdominis	3
Biceps	[illegible]	Extensors of toes	16	Intercostals	2
Extensor pollicis longus	41	Anterior tibial	10	Sternocleidomastoid	1
Flexor pollicis longus	30	Hamstrings	3	Serratus anterior	1
Multiple injuries of tendons, nerves, vessels	47	Flexor hallucis longus	3	Pectoralis minor	1
Palmaris longus	15	Posterior tibial	3		
Flexor carpi ulnaris	17	Peroneus longus	2		
Flexor carpi radialis	11	Peroneus tertius	2		
Abductor pollicis longus	10	Adductors			
Extensor pollicis brevis	8	Pyriformis	1		
Triceps	6	Obturator internus	1		
Thenar group	7	Sartorius	1		
Brachioradialis	5	Gracilis	1		
Extensor carpi radialis, longus and brevis	4	Adductor hallucis	1		
Extensor carpi ulnaris	4				
Hypothenar group	3				
Brachialis	2				
Interossei	1				
Total	856 (84.4%)	Total	143 (14.1%)	Total	15 (1.4%)

disruptions of the upper extremities The quadriceps, tendo achillis and triceps surae (not including the tendo achillis), represented 67.8% of the disruptions of the lower extremities

The flexors of the fingers were the structures most commonly disrupted in the upper extremity and more than 94% of all loss of continuity of these flexors was due to lacerating injuries. Lacerations accounted for 77.7% of the disruptions of the finger extensors and 76.7% of the disruptions of the extensor pollicis longus These three groups of tendons were the commonest sites of lacerating injuries in the upper extremity

The musculotendinous cuff was disrupted as a result of direct trauma stress or miscellaneous cause more often than any other structure in the upper extremity There were no lacerations of the musculotendinous cuff of the shoulder, however Of 182 tears of the cuff 19.7% were not associated with injury directly to the shoulder or indirectly via a fall on the

parently does not reflect the true incidence of the disorder

The syndrome consists of pain tenderness and swelling that involves the cartilage adjacent to the sternum. The 2d costal cartilage is most often involved followed by the sternoclavicular cartilage the 3d cartilage then the other costal cartilages Pain may be mild or severe. Usually the pain is localized but it may radiate widely Pain is accentuated by deep respiration and by the recumbent position. Swelling may be visible but often is detected only by widening of the cartilage and induration on palpation. The overlying skin is normal The illness may cease spontaneously in a few days or may be continuous or remittent for months or years Prognosis is excellent.

Treatment is symptomatic. Heat and salicylates are helpful X ray therapy is of little or no benefit The authors used local infiltration of procaine in 3 patients and obtained prompt complete relief that lasted well beyond the time usually expected from procaine anesthesia The prolonged comfort afforded by procaine infiltration may indicate an interruption of some vicious cycle.

The term parasternal chondrodynia is suggested for this disorder Criteria for diagnosis include parasternal involvement of cartilage manifested by tenderness swelling and usually pain normal overlying skin, absence of other causative disease or trauma and relief from pain and tenderness by local infiltration of procaine

► [As yet, the cause of Tietze s syndrome has not been determined. The patients are indeed uncomfortable I have found, in what few patients I have treated, that the injection of the painful area with not only a local anesthetic agent but with inclusion of 37 5 mg hydrocortisone has been of value and often relieved the condition dramatically and permanently —Ed]

Disruption of Muscles and Tendons Analysis of 1 014 Cases is presented by Sanford H Anzel Kenneth W Covey Alan D Weiner and Paul R. Lipscomb[7] (Mayo Clinic and Found) Disruptions of the upper extremity were 6 times as common as those in the lower extremity and disruptions of the trunk accounted for a small percentage of the total (Table 1) Of the 1 014 disruptions 598 were due to lacerations and 416 were due to other causes 269 were partial or incomplete. In the upper extremity 63 1% of the disruptions were due to laceration 21% to excess stress or miscellaneous

(7) Surgery 45 406 414 March, 1959.

causes including tear occurring with normal activity, and 15.9% to direct injury without an open wound. In the lower extremity 40.5% were due to laceration, 44.8% to excess stress and miscellaneous causes and 14.7% to direct injury without an open wound.

The flexors and extensors of the fingers plus the musculotendinous cuff and biceps brachii represented 76% of the

TABLE 1—ANATOMIC DISTRIBUTION OF 1,014 DISRUPTIONS OF MUSCLES AND TENDONS

UPPER EXTREMITY	NUMBER	LOWER EXTREMITY	NUMBER	TRUNK	NUMBER
Flexors of fingers	16	Quadriceps mechanism	54	Left hemidiaphragm	6
Extensors of fingers	104	Tendo achillis	22	Trapezius	2
Musculotendinous cuff	182	Triceps surae	21	Rectus abdominis	2
Biceps	60	Extensors of toes	16	Intercostals	
Extensor pollicis longus	51	Anterior tibial	10	Sternocleidomastoid	1
Flexor pollicis longus	30	Hamstrings	3	Serratus anterior	1
Multiple injuries of tendons, nerves, vessels	47	Flexor hallucis longus	3	Pectoralis minor	1
Palmaris longus	18	Posterior tibial	3		
Flexor carpi ulnaris	17	Peroneus longus			
Flexor carpi radialis	11	Peroneus tertius			
Abductor pollicis longus	10	Adductors			
Extensor pollicis brevis	8	Pyriformis	1		
Triceps	8	Obturator internus	1		
Thenar group	7	Sartorius	1		
Brachioradialis	5	Gracilis	1		
Extensor carpi radialis, longus and brevis	4	Adductor hallucis	1		
Extensor carpi ulnaris	4				
Hypothenar group	2				
Brachialis	2				
Interossei	1				
Total	856 (84.4%)	Total	143 (14.1%)	Total	15 (1.5%)

disruptions of the upper extremities. The quadriceps, tendo achillis and triceps surae (not including the tendo achillis), represented 67.8% of the disruptions of the lower extremities.

The flexors of the fingers were the structures most commonly disrupted in the upper extremity and more than 94% of all loss of continuity of these flexors was due to lacerating injuries. Lacerations accounted for 77.7% of the disruptions of the finger extensors and 76.7% of the disruptions of the extensor pollicis longus. These three groups of tendons were the commonest sites of lacerating injuries in the upper extremity.

The musculotendinous cuff was disrupted as a result of direct trauma, stress or miscellaneous cause more often than any other structure in the upper extremity. There were no lacerations of the musculotendinous cuff of the shoulder, however. Of 182 tears of the cuff 19.7% were not associated with injury directly to the shoulder or indirectly via a fall on the

outstretched arm 48.9% were due to direct injury to the region of the rotator cuff

The biceps brachii ranked among the top three structures in number of disruptions in all etiologic groups except lacerations The long head of the biceps was the usual site of disruption however 1 patient had rupture of the short head. In 40 6% of the patients with disruption of the biceps the cause was indirect (stress) trauma. Disruptions involving the biceps and musculotendinous cuff occurred in 15 patients

Previous fractures about the wrist had occurred in 8 of 11

TABLE 2.—PREDISPOSING FACTORS

Factor	Cases
Tendinous calcification	28
Osteoarthritis	27
Old fracture	10
Idiopathic roughening or deformity of bone	10
Spurs and exostoses	7
Rheumatoid arthritis	2
Tuberculous tenosynovitis	2
Tumor	1
Total	87

stress ruptures and miscellaneous injuries of the extensor pollicis longus tendons Seven disruptions were associated with Colles fractures and 1 with Barton s fracture No history of injury could be elicited in 2 patients and in 1 disruption occurred while the patient had been playing a game of curling Of 14 disruptions of the extensors of the fingers due to miscellaneous causes 9 occurred spontaneously or were of unknown cause and 2 were associated with normal activity

The quadriceps femoris was the commonest site of disruption in the lower extremity Of 54 disruptions 40 1% were due to indirect (stress) trauma and 38.9% to direct trauma. Slightly more than one third of the disruptions were in the patellar ligament whereas more than one half were in the quadriceps tendon and its lateral expansions

Rupture of the tendo achillis occurred about one half as often as did rupture of the quadriceps mechanism More than 50% of the ruptures of the tendo achillis were due to indirect injury the rest were due to lacerations

More than 50% of the disruptions of the triceps surae were due to indirect (stress) injury whereas in 42 8% of the patients no history of injury could be elicited. This group of

muscles accounted for three fourths of all disruptions of the lower extremity due to miscellaneous causes

In 87 (87%) of all the patients on whom data were reviewed, factors that probably predisposed to muscle-tendon disruption were present (Table 2) Tendinous calcification and osteoarthritis each accounted for about one third of the total number

Radiologic Manifestations in Tuberose Sclerosis According to P H Whitaker[8] (Univ of Liverpool) radiology may



Fig. 196. (Courtesy of Whitaker P H.: Brit. J Radiol. 32 152 156, March, 1959)

help in diagnosis of sclerosis tuberosa by demonstrating defects in the viscera due to adenomas, cystic changes in the lungs, calcification in areas of gliosis in the cerebrum and skeletal changes Changes can occur anywhere in the skeleton and have been described as fibrocystic cystic and scle

(8) Brit. J Radiol. 3 152 156, March, 1959

rotic Irregular areas of increased density have been reported by several authors in the skull spine hands and feet. In 2 patients similar changes were observed in the long bones. Punched-out cystic areas in the terminal phalanges are characteristic of the disorder Whitaker reports 3 cases in which the skeletal changes were prominent.

CASE 1—Youth 17 was a classic epileptic of subnormal mentality He had typical facial adenomas, a subungual fibroma and scattered pigmentation of the trunk. Calcification was present in the brain. The skull bones showed mottled sclerosis

CASE 2—Boy 9, an ament with the clinical stigmas of sclerosis tuberosa showed besides the mottled appearance of the skull and brain calcification, fibrocystic expansion of one rib (Fig 196)

CASE 3—Woman, 37 an epileptic of subnormal mentality had facial adenomas and subungual fibromas of the hands and feet. Pulmonary changes were present. The whole frontal bone showed ill-defined thickening with diffuse mottled appearance and some asymmetry of development. Multiple areas of irregular, increased density were present throughout the spine and pelvis. Small areas of subperiosteal cortical sclerosis were observed in the hands, feet and tibiae. There were punched-out cystic areas in the terminal phalanges of several fingers.

Bones—Metals—Surgeons Carl D Martz[9] (Indianapolis) states that orthopedic surgeons by nature find themselves concerned and active in human engineering with bone and metal Reinforcement and replacement of bone by metallic devices plunges into depths of metallurgy stress analysis, engineering and design in which there are many unknowns. An area of biomechanics is emerging which combines the contributions of many special fields into an understanding of the mechanical aspect of body function

Cooperation is needed between the surgeon and those who design manufacture and test devices used to reinforce and replace body parts The problems common to all concerned must be described in a common language and the strategies, principles of design and technical practices planned for the solution of these problems be understood by all

Among the factors that must be carefully considered Martz mentions the need for determination of the amount of force that will be exerted on a device the endurance limits of the material the withdrawal and bending loads of screws the effect of surface defects including those resulting from scratching bending or notching of devices corrosion re-

(9) J Indiana M A 52 60-64 January 1959

sistance of the material, the returning strength gradient of healing bone and the supporting role of fascial envelopes and muscle masses

Orthopedic surgeons are presently endeavoring to win the cooperation of pathologists, so that implants and surrounding tissues when removed will be studied in the same manner as other tissues Accumulation of data concerning mechanical failure is imperative, and failing devices will benefit from further study by stress analysts and metallurgists

Bone and Joint Changes Following Burns Roentgenographic Study, Preliminary Report is presented by E Burke Evans and James R Smith[1] (Univ of Texas) Of 950 patients with burns of all severity 20 had skeletal alteration



Fig 197 (left) —Right, unburned elbow 3 months after injury shows heterotopic bone arising apparently from area of biceps insertion.
Fig 198 (right) —Seven months after burn mature structure of new bone is evident. From this stage it regressed in size as general condition of patient improved.
(Courtesy of Evans, E. B., and Smith, J R.: J Bone & Joint Surg. 41 A.785-799 July 1959)

other than osteoporosis In some more than one type of alteration was observed Skeletal alterations were seen more often and to a greater degree in children than in adults Changes were observed in all major joints of the extremities Hips and elbows were frequently sites of involvement shoulders wrists and knees were rarely involved despite their frequent inclusion in the burned area

Periosteal new bone formation was observed in 3 patients It occurred in bones underlying areas of severe burn or in conjunction with a destructive process in an adjacent joint. Time of detection of this change varied from the 4th to 9th month after the burn. Continued proliferation was never noted after skin coverage. It is presumed that the re

(1) J Bone & Joint Surg 41 A:785-799 July 1959

action is secondary to the acute hyperemia or to that accompanying the chronic inflammatory process

Irregular calcification in the intimately periarticular structures was an independent finding in 7 patients and accompanied more dramatic change in others The calcific densities were in the plane of ligaments or overlying tendons and had no attachment to bone. Onset, in 3 cases in which it could be established was in the 2d or 3d month after the burn. In all but 1 case there was adjacent or overlying burn. In some patients this spotty calcification heralded more serious joint impairment in others it disappeared and in still others it remained unchanged about a freely movable joint.

Osteophyte formation was observed in 7 patients (6 adults) In none was there adjacent burn. Time of onset was not determined. These growths may progress to complete bridging of a joint or may gradually decrease in size.

True para articular osseous bridging was observed at the hip elbow or shoulder in 4 patients 3 were children (Figs. 197 and 198) Proximity of the involved joint to the burn area was not consistently a factor in production of heterotopic bone. The repeated minor trauma of routine handling or dressing change may be the chief precipitative factor In 1 patient time of onset was in the 3d month after the burn (Fig 197) In the others time of onset could not be determined.

Progressive destruction of one or more joints with eventual fibrous or bony ankylosis occurred in 7 patients (all children) In some, complete articular destruction occurred in a few weeks and ankylosis in a few months Joints most often involved were the elbow hip and ankle. Some involved joints were not near burned areas The process resembles that seen in septic arthritis and might be initiated by transient bacteremia or septicemia. However examination of two ankles in surgically removed lower extremities with almost total deep third-degree burn disclosed pannus formation and fibrinous adhesions with suppuration. This finding suggests that the degenerative process could be initiated without bacterial invasion.

Surgical excision of ectopic osseous or calcified tissue in burn cases is *feasible, but should not be undertaken until* the patient s general condition is good and all scar tissue is mature and soft

Periarticular Ossification Following Burns Basil M Boyd, Jr, William M Roberts and George R Miller[2] report that periarticular ossification (Fig 199) occurred in 6 children, aged 3 13, out of about 1,000 patients treated for severe burns an incidence of 0 6% The reason for the occurrence



Fig 199—Periarticular ossification bout left elbow completely bridged anteriorly but incomplet posteriorly (Courtesy of Boyd, B M, Jr, *et al*: South. M J 52 1048-1051 September 1959)

of this complication in the occasional burn case is not known In 2 patients calcification occurred about joints the covering skin of which was not directly involved in the burned process. In no case was it thought that the burn extended down to the capsular structures about any of the joints These two factors suggest that some alteration in metabolism plays a large role in the production of periarticular ossification. However as Johnson and others have pointed out no specific chemical alterations have been found in the blood All 6 of these patients were girls and all 3 of Johnson s patients were females

(2) South. M. J 52 1048-1051 September 1959

ditional mucous membrane is needed it can be taken from the inner surface of the cheek

One great advantage of the electrokeratotome over previous methods of dissecting buccal mucous grafts is that it cuts the grafts so thin that they do not need further thinning In addition, the buccal area from which the graft is taken does not need to be sutured but is epithelialized within a few days

Soft-Tissue Injuries to Face were studied by John B Erich[3] (Mayo Clinic) When possible injured soft tissues of the face should receive attention within a few hours after the damage. Early treatment not only limits the degree of inflammatory reaction but also reduces the amount of subsequent scarring and distortion Hydrogen peroxide is an effective agent for removing debris and coagulated blood from lacerated wounds, leaving clean tissues for suturing It is inexcusable to fail to remove dirt and other pigmented foreign material from abraded and lacerated surfaces by vigorous scrubbing with a stiff brush soap and water Such foreign substances if permitted to remain in a wound leaves a permanent, tattoo-like pigmentation in the skin that is impossible to remove except by excision

The ultimate formation of scar tissue always is diminished by sharp excision of rough irregular ragged or macerated wound margins Lacerations obliquely cut require excision to make the skin edges perpendicular to the external dermal surface this is essential for proper wound suturing Portions of the skin in which the blood supply is so poor that sloughing is likely to occur should be removed promptly Because hematoma formation is undesirable, it is extremely important that no facial wound be closed before bleeding has been controlled by ligating all vessels that continue to ooze.

Heavy sutures that include large amounts of tissue are unsatisfactory because they produce a great deal of unnecessary scarring Neat, small stitches of fine material such as silk, are essential in obtaining a satisfactory result.

After a facial wound is closed, use of a pressure dressing is extremely helpful. Such dressings promote rapid healing and further obviate the possibility of hematoma

Creation of Alveolar Ridge after Bone Transplantation to

(3) Texas J Med. 55 806-810 October 1959

Mandible A Rehrmann[4] (Düsseldorf Germany) emphasizes that in planning reconstruction of the mandible, two points must be kept in mind to recreate as nearly as possible its normal shape and to restore its normal function The normal shape of the mandible is characterized by the full width of the bony arch. The implants must be inserted in line with the remaining stumps overlapping the margins of the mandible only with thin edges These essentials are important for the later creation of an alveolar ridge In recreation of a chin the implanted bony arch must not follow a downward line because it is later necessary to add a second layer of bone to create a ridge of sufficient altitude.

TECHNIC.—A cut is made along a line parallel to the intended ridge. The buccal and lingual tissue layer is lifted off downward, and care is taken to leave the periosteum and a slight tissue layer over the mandible or bone graft to provide the take of a skin graft. The lower wound margins are sutured into position near the lower edge of the bone by a special suturing method. After this the mandible or implant has the shape of a well formed ridge. Thin-split skin flaps are fitted to the raw buccal and lingual surface of the bone by use of the patient's dental prosthesis that has been adapted exactly to the exposed bone with impression compound. The flaps are fixed to the adapted compound surface with mastic solution and the prosthesis is placed and secured to the mandible by circumferential wires The prosthesis is removed after 10 days, the impression compound replaced by acrylic material within a few hours and the prosthesis is immediately reinserted to prevent shrinkage of the new fornix.

In cases of bone transplantation this operation should be performed after full incorporation of the implanted bone. This takes about 1 year The correct size of the original bone graft determines the shape of the ridge, and careful planning and designing of the bone cross-section when doing the first grafting operation is of paramount importance. A ridge at least of the diameter of the little finger should be achieved

► [A surgical approach to the correction of troubling and disabling defects of the mandible is presented. By means of this direct approach, a large number of patients who formerly were relegated to a class of jaw cripples may be restored to a state of normalcy —Ed.]

New Plastic Procedure for Hypospadias was used by Manlio Cucci[5] (Ancona Italy) in 12 patients For correction of curvature of the penis an inverted V incision is used with the point in the region of the frenulum and the branches that extend through the folds of the prepuce liberating the lower surface of the penis from all fibrous tissues that retract it.

(4) Plast. & Reconstruct. Surg. 4 183-189 August, 1959
(5) J Internat. Coll. Surgeons 30 587 590 November 1958.

Urethroplasty is carried out at the same operation (Fig 201) proceeding to a penoscrotal symphysis (after Leveuf Landerer and Bucknall), leaving regeneration of a neourethra to a band of scrotal skin delimited by an inverted U incision in

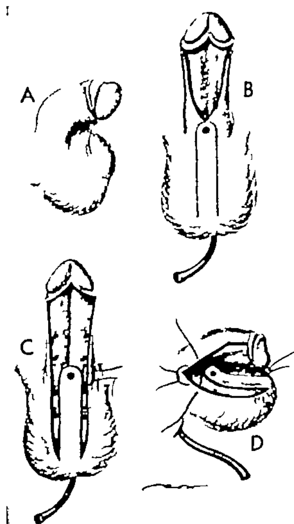


Fig 201 —First stage (personal technic) *A* penile hypospadias with ventral incurvature *B* Inverted incision with liberation of retracting tissue Inverted U incision is outlined, including at its base hypospadial meatus. *C* Incision is prolonged so two bleeding surfaces can be joined. *D* proceeding to penoscrotal symphysis. In this patient, provision for perineal diversion of urine is necessary (Courtesy of Cuccu, M.: J Internat. Coll. Surgeons 30 587 590 November 1958.)

cluding at the base the meatus of the hypospadias with branches as long as the penis extending to the scrotal raphe This technic requires temporary perineal catheterization for 10 days After removal of the catheter the stoma of the urethral bulb is closed spontaneously in 2 or 3 days

At a 2d stage, after about 60 days the penis is detached from the scrotum with Z flaps to cover bleeding surfaces with oblique closure on the inferior surface of the penis to avoid retractile scars as much as possible. In these patients the scars resemble keloids as in cryptorchism

Thus in most patients the usual preliminary operation for straightening of the penis can be avoided because this is accomplished at the same time as the urethroplasty This reduces hospitalization for both procedures to about 20 days Of the 12 patients none had such complications as partial disunion or fistula.

For this operation an abundant scrotal mass is necessary which means that the procedure should never be attempted before age 5 The procedure is not suitable for testicular ectopies with undeveloped scrotum. In such cases it would be well to commence with orchiopexy because the scrotum normally used can develop sufficient tissue to wrap around the penis

Late results of this technic cannot be evaluated but the simplicity of the method and excellent immediate results are sufficient to recommend its further use.

Management of Anterior Cranial and Upper Facial Injuries is summarized by Gordon S Dugger and Erle E. Peacock Jr[6] (Univ of North Carolina) Though the combination of trauma to the upper part of the face and anterior portion of the cranium is relatively common the correct timing and selection of operative procedures for these complicated injuries are often perplexing After hemorrhage is controlled and a dependable airway established, considerable judgment must be exercised in deciding which aspects of the injury will require operative correction and the priority or correct timing for these procedures Errors are often caused by several specialists acting independently within rigid anatomic boundaries

Restoration of the eyelids and alleviation of rapidly increasing intracranial pressure from an epidural hemorrhage are emergency procedures that must be performed without delay if blindness and death are to be prevented. Other soft-tissue wounds can be closed immediately or delayed if the patient's general condition is precarious If an emergency operation is not necessary to decompress the cranium or

(6) Surg Gynec. & Obst. 109:613-620 November 1959

cover the cornea, the surgeon will usually be able to wait 4 or 5 days before other injuries demand operative correction. Rhinorrhea fractures overlying dural tears and restoration of the inner canthus and nasal armature require correction at about 4-6 days after injury for optimal results Midface and upper jaw fractures may be delayed a few days longer but usually these fractures should be reduced within 10 days. Reduction of lower jaw fractures may be postponed as long as necessary Intracranial hematomas should be considered on an individual basis because they may develop rapidly and require early evacuation or may develop slowly and not be suspected for several weeks

Orbital rim fractures should be individually reduced through separate incisions, if necessary then fixed by direct wires Dislocation of the zygoma should be reduced with a bone hook and fixed by cantilever action with a transverse Kirschner wire. Fractures of the nasal bones and inner canthus avulsions cannot be held satisfactorily with an external splint. Transverse wires passed through the fracture lines in the nasal bones and tied over padded lead plates on either side of the nose provide the surest restoration of depth on the sides of the nose

► [Any severe fracture of the face deserves surgical intervention designed to adjust all tissues into a normal relation at the earliest possible moment compatible with the patient's physiologic requirements for safety Fractures involving the orbital rim with possible rupture of the orbital floor and distortion of the orbital muscles from tears, trauma or other injury should receive immediate adjustment otherwise, inflammatory reaction with associated fibrosis around the muscles will take place and an irreversible fixation will follow Once this is established, the patient is doomed to permanent disfigurement which may end in diplopia, enophthalmos, lateral deviation of the eye, fixation of the globe or depressed bony defects of contour These may all be avoided if the defects are corrected during the first 6-10 hours following the accident.

With blood banks and antibiotics available and consultation established with a competent neurosurgeon, a capable plastic surgeon should be able to care for any severe facial fracture immediately—except in those cases where severe brain damage has occurred.—Ed]

Reconstructive Surgery of Leg and Foot. Richard B Stark and Desmond A. Kernahan[7] (St Luke's Hosp New York) point out that conditions of the lower limb that present commonly and necessitate plastic surgery are surfacing problems associated with fractures of the tibia stripping avulsions of the skin (rotary wheel injury) ulcers or unstable scars from conditions other than fracture (osteomyelitis pressure de-

(7) S. Clin. North America 39 469-490 April, 1959

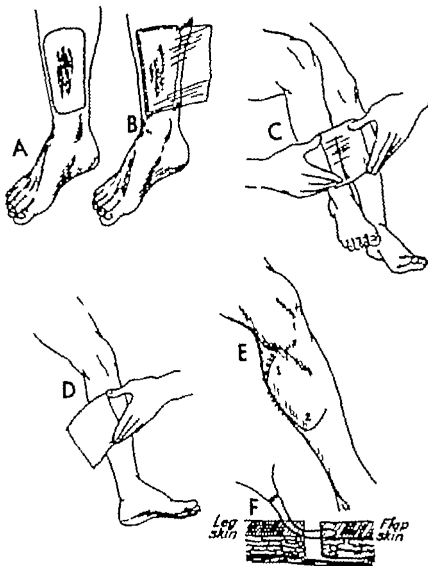


Fig. 202.—Cross-leg flap procedure. *A*, defect marked for excision. Two considerations influence extent to which defect is excised: area of deep fixation of epithelium is excised totally; and excision of more rather than less tissue is preferable even if it means resection of normal tissue because this moves circular scar of pedicled flap more peripherally and lessens thereby likelihood of producing small, scar-locked, edematous flap. *B*, pattern is made of distal end of defect to be covered by pedicled flap. Base of pattern that is to correspond to pedicled bridge is left long. *C*, legs are brought together in close approximation in side-to-side position and pattern is transferred to donor calf. *D*, defective leg is abducted and pattern falls to rest usually on medial calf, which is most vascular donor area of leg. *E*, in all but children and young adults, pedicled flap is prepared in stages, usually 2, by incision, undermining and suture to enhance venous clearance and arterial blood supply. *F*, horizontal mattress stitch used during staged preparation of flap to avoid scar with sutures and hence to encroach on flap margins. Mattress stitch picks up dermis of flap only. (Courtesy of Stark, R. B., and Kernahan, D. A.: S. Clin. North America 39: 469-490, April, 1959.)

cubiti or decubiti due to reduced or absent cutaneous sensation), ulcerations due to vascular disturbances and lymph edema. Most of these injuries lend themselves to repair by the cross leg procedure (Fig 202)

TECHNIC.—Using translucent material such as a polyethylene sheet, *a pattern is made of the lateral margin of the outlined defect* and the proximal and distal ends of the defect are extended out parallel to each other to form, as it were, a pedicled bridge for the pattern. The legs are approximated in close juxtaposition to each other until a position is found in which the pedicle may be removed from an area overlying muscle on the donor leg a position that allows a reasonable degree of comfort and in which the pedicled bridge between donor and recipient legs can be reduced to a minimum.

The pedicle of the pattern is placed on the donor leg and secured, using adhesive. The defective leg is withdrawn and the pattern allowed to fall on the donor calf where it is outlined with marking material. The medial calf is used most commonly as the donor area.

Applying a plaster cast to each extremity preoperatively will assist transfer of the flap from one lower extremity to the other After the transfer interextremity immobilization is completed by the locking device incorporated in the plaster casts.

The period that the legs must remain joined to allow development of an autonomous blood supply in the flap from the recipient site generally may be set at 3 weeks. During the time the legs are fixed relative to one another by plaster casts, a program of physiotherapy should be undertaken to massage all joints of the lower extremities not immobilized.

Three weeks after transplantation, division of the pedicled bridge is undertaken. Because the flap must live now on a blood supply obtained through scar often a narrow band of necrosis occurs at the divided edge of the pedicled bridge, a happenstance to which the authors apply the term "severance slough." To avoid severance slough the pedicle should be divided in stages by electric cautery This step is repeated several times on alternate days using local anesthesia. Because the extremities must remain in their casts the cautery prevents bleeding that is difficult to control otherwise because of the close juxtaposition of the legs. After the bridge is separated, the casts are removed. Several days pass before final trimming is done and inset of the flap During this time, saline dressings are applied to the legs. In this way severance slough is minimized or eliminated.

Gracilis Muscle Transplant for Correction of Neurogenic Rectal Incontinence was performed by *Kenneth Pickrell* Nicholas Georgiade E Fredrick Richard and Frank Morris[8] (Duke Univ)

TECHNIC.—With the fingers of the left hand placed medial to the adductor tendon and in the groove between it and the gracilis muscle, a vertical incision about 2 in. long is made directly over the upper fourth of the gracilis muscle (Fig 203) The incision is deepened through

(8) S. Clin. North America 39 1405 1415 October 1959

the subcutaneous fat to expose the fascia which is incised. The muscle is freed inferiorly in its canal by blunt finger dissection. With the index finger hooked around the muscle belly tension is exerted on the muscle and, while doing so the path of the gracilis along the inner aspect of the thigh is disclosed.

A second incision about 2 in long is made parallel with the long

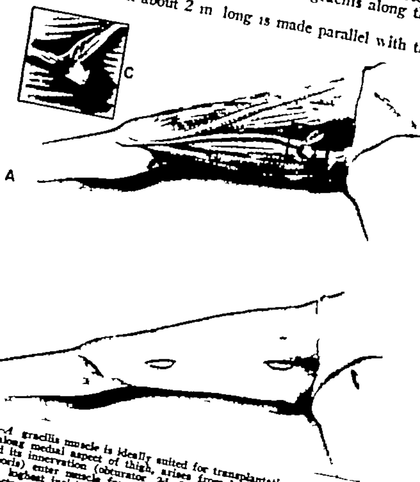


Fig 203.—*A* gracilis muscle is ideally suited for transplantation. It is most superficial muscle along medial aspect of thigh, arises from lower half of symphysis and pubic arch and its innervation (obturator 2d, 3d and 4th lumbar) and blood supply (profunda femoris) enter muscle from lateral side near its origin as neurovascular bundle (*C*). *B* highest incision in thigh is made just medial to tendon of adductor longus in adductor gracilis groove or trough. Care is exercised to avoid injury to neurovascular bundle. Second incision is made parallel to muscle over its lower third. Traction placed on muscle through highest incision will disclose path of muscle. Third incision in oblique direction is made along upper and medial aspect of tibia to preserve dovetail insertion of gracilis into periosteum of tibia. All incisions are connected by subcutaneous tunnels through which muscle is mobilized. (Courtesy of Pickrell, K., *et al.* S. Clin. North America 39 1405-1415, October 1959.)

axis of the muscle over its lower third and just above the knee. At this point, the gracilis is situated just posterior to the sartorius muscle. Here the gracilis becomes tendinous. After identifying the oval tendon of the gracilis, the muscular portion is freed superiorly by blunt finger dissection. It may be necessary to incise the fascia along the muscle to free it completely. The lower leg is flexed to 90 degrees at the knee. This relaxes the gracilis tendon, which is then freed by blunt finger dissection inferiorly as it passes behind the medial con

dyle of the femur, the knee joint, and curves around the medial condyle of the tibia.

A third incision about 2 in. long is made in oblique direction along the upper and medial aspect of the tibia, where the tendon of the gracilis flattens and dovetails into the body of the tibia below the condyle and tuberosity of the tibia. Traction on the muscle through the incision in the lower thigh will identify the termination of the gracilis so the entire dovetail insertion can be preserved. This incision should be adequate, and enlarged if necessary to expose the termination of the

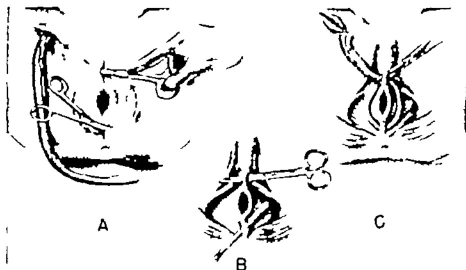


Fig. 204.—*A* with absence of muscle tone and structural support, perineal floor will bulge when patient is placed in exaggerated lithotomy position. Incisions are made at 12 and 6 o clock. Subcutaneous tunnel is made around anus. Tunnel also made to connect highest incision of thigh, with incision at 12 o clock. *B* when possible, pulleys are constructed from anterior and posterior raphes. *C* gracilis tendon and muscle are threaded through tunnels and beneath pulleys, if they have been constructed. (Courtesy of Pickrell, K. *et al.* S. Clin. North America 39 1405-1415, October 1959.)

gracilis so the entire dovetail insertion can be preserved with its periosteal attachment to the tibia.

The freed end of the muscle is made to present through the incision along the lower third of the thigh. The tendon is kept warm and moist with saline sponges. With a finger hooked around the origin of the muscle, through the highest incision in the thigh, the entire muscle is drawn through the subcutaneous tunnel and made to present through the highest incision in the thigh. Finger or blunt scissors dissection will suffice to sever any fascial bands that adhere to the muscle. The lower incisions are closed in layers, using interrupted silk sutures after perfect hemostasis has been obtained.

The foot of the operating room table is lowered, the patient's legs and thighs are flexed and placed in exaggerated lithotomy position to expose the entire perineum. Small superficial incisions are made in the anterior and posterior commissures at 12 and 6 o clock, beginning about 1 in. from the mucocutaneous junction (Fig. 204). A subcutaneous tunnel is made around the anus in the adipose tissue using

blunt scissors. The tunnel should be of sufficient size to admit the index finger with ease. The undermining should extend almost to the mucocutaneous junction. A subcutaneous tunnel is now made to connect the incision at 12 o'clock with the highest incision in the thigh. This tunnel should be of sufficient size to admit 2 fingers freely and to allow the muscle to move and glide freely without fear of strangulation. The gracilis muscle is threaded through the thigh to the perineal tunnel. The tendon and muscle are now threaded around the anus to make a complete circle.

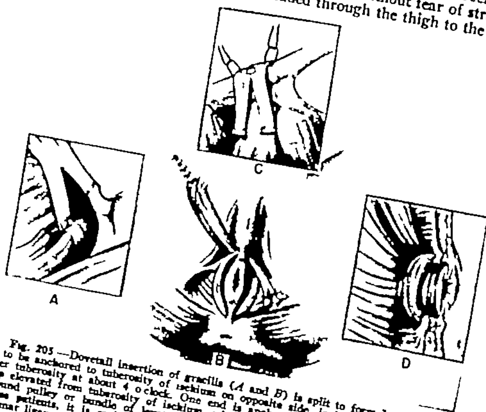


Fig. 205.—Dovetail insertion of gracilis (*A* and *B*) is split to form Y. If gracilis is to be anchored to tuberosity of ischium on opposite side, incision is made directly over tuberosity at about 4 o'clock. One end is anchored around pulley or periosteal flap elevated from tuberosity of ischium, whereas other limb of dovetail is anchored around pulley or bundle of levator ani muscle using silk sutures. *C*, In heavy or obese patients, it is easier and better to anchor gracilis to adductor tendon or to lacunar ligament. Incision is made in groin on side opposite transplant. Subcutaneous tunnel is formed to connect it with incision at 12 o'clock. Tendon is threaded through tunnel and beneath lacunar ligament or tendon of adductor on opposite side. Gracilis tendon is then anchored to itself and to ligament on each side, using silk sutures. *D*, Anal orifice is constricted and closed by collar of contractile muscle. (Courtesy of Pickrell, K., *et al.*: S. Clin. North America 39:1405-1415, October 1959.)

The tendinoperiosteal end of the gracilis may be anchored to the periosteum of the ischium and levator ani muscle or more easily to the medial end of the inguinal ligament (Poupart) lacunar ligament (Gimbernat) or to the fixed tendinous origin of the adductor longus. A transverse incision about 2 in. long is made directly over the tuberosity of the ischium on the side opposite the muscle transplant. This incision will be located at about 4 o'clock, with the thighs flexed in exaggerated lithotomy position. The incision is deepened to expose the tuberosity of the ischium, as well as the lateral aspect of the levator

ani muscle (Fig 205) A periosteal flap or pulley is elevated from the tuberosity of the ischium A pulley is also made from a heavy bundle of the levator ani. The dovetail tendinoperiosteal insertion of the gracilis is split for 1 or 2 cm. One half of the dovetail is anchored with silk sutures around the periosteal pulley or directly into a periosteal flap over the prominence of the ischium. The other half of the dovetail is anchored around and beneath a pulley of levator ani using silk sutures. Regardless of whether the tendinous end of the gracilis is anchored over the tuberosity of the ischium, to the adductor tendon or to the ligament in the groin, final fixation of the tendon is not decided on or fixed until the legs have been drawn down into line with the body

Subtotal Reconstruction of Thumb Tubed Pedicle Flaps with Tactile Restoration. Reconstruction of thumb loss proximal to the metacarpophalangeal joint can be accomplished most effectively according to Alexander P Kelly Jr[9] (Henry Ford Hosp) by digital transfer preferably of the index finger Littler s neurovascular pedicle technic is the method of choice

The surgeon confronted with the problem of loss at the metacarpophalangeal joint or through the proximal phalanx may feel that the sacrifice of a normal digit to reconstruct the thumb is unwarranted. In this type of patient the tubed pedicle flap and bone graft are most suitable. This type of reconstruction is particularly applicable when some type of pedicle flap must be used to obtain primary closure to avoid further sacrifice of bone length.

Amputations involving the distal phalanx or distal interphalangeal joint need only to be closed by a pedicle flap preferably from another digit, to retain a possible length and have a suitable tactile surface Kelly found dorsolateral flaps from the 3d digit well suited to this situation.

The only disadvantage of the tubed pedicle flap is its lack of stereognosis The patient complains that the flap feels dead despite demonstration of thermal pain, pressure and light touch sensory discrimination. Kelly relieved these deficiencies by two approaches by transfer of a normal flap of soft tissue on its neurovascular bundle from a less important area of the hand, as suggested by Littler and by transfer of the palmar skin on a proximally based rotation flap

(9) A.M.A. Arch. Surg 78 582 585 April, 1959

Improving the Take of Composite Grafts Gordon Davenport and Frank D Bernard[1] (Univ of Wisconsin) describe a technic of composite grafting Of 17 grafts there were no total failures and only 3 partial losses

TECHNIC.—General anesthesia is usually used. The most pertinent feature of this technic is the preparation of the graft and recipient site so that the area of raw surface contact is increased. The margin of the nasal defect is converted into a wedge that is fitted into a groove in the margin of the graft. More specifically a strip of skin or scar epithelium at least ⅛ in. wide is removed from the margins of the defect on the inside and outside of the nose. Bleeding is controlled by pressure vessel ligatures are avoided if possible. An appropriate sized graft is taken from the ear lobe, and a groove at least ⅛ in. deep is cut on the raw surface. Thus a tongue in-groove union is produced that increases the raw surface contact by an estimated 50% The graft is sutured into place and the donor site is closed.

In the partial failures the suturing technic was at fault. Originally in trying to secure close firm contact between the graft and defect a rather generous bite of the graft was taken and the sutures placed close together However it was noted that the ring of close sutures in the graft formed a barrier to the full progress of vascularization Within 24 hours the graft showed the blue color of early blood supply The area beneath the sutures progressed to a healthy pink but the center of the graft remained blue and eventually died of venous congestion Since this observation a minimum of sutures is used and these are placed close to the margins No subcutaneous sutures are taken Since changing the suturing technic no grafts have been lost

The nostril is lightly packed with petrolatum gauze A small dressing is placed over the graft and held firmly in place with multiple strips of adhesive. The dressing is not an attempt to reduce venous congestion but helps to immobilize the graft and protects it from subsequent trauma. Dressings and sutures are removed on the 5th postoperative day

The patients were aged 4-71 Many of the grafts were to alar defects In addition one graft was successfully placed in a nasolabial flap that had been previously rotated to the nose One graft took well in a postirradiation defect of the

(1) Plast. & Reconstruct Surg 4 1 5-18, August, 1959

alar rim. There was no significant shrinkage of grafts Color match was good though slight alteration of pigmentation was noted in a few grafts

► [This article clearly points out the importance of "little things." Frequently it is the presence or absence of the little things which makes the difference between success and failure. Too much time cannot be devoted toward the analysis of these. Despite the fact that skin grafting is one of the oldest procedures in plastic surgery our best efforts today leave much to be desired.—Ed.]

Historical Development of Free Skin Grafting is cited by *Blair Oakley Rogers*[2] *(New York Univ)* *Free skin grafting* always implies that the skin is completely detached from the body and thus from its underlying blood supply when it is transplanted to another part of the body The words free" and graft' therefore should be considered synonymous in any discussion on methods of skin transplantation The other basic method consists of transplanting skin pedicles or flaps Use of the word pedicle or flap always implies that the skin and its underlying subcutaneous tissue remains temporarily attached to the body where it continues to receive its blood supply through a pedicle attachment or flap during the time intervals taken up by the stages required for transfer to another part of the body

Three types of skin grafts have been used by plastic surgeons the autograft obtained from one part of the body and transplanted to another part of the same body the homograft obtained from one individual and transplanted to another of the same species e.g man to man rabbit to rabbit and the heterograft obtained from an individual of one species and transplanted to one of another species e.g man to guinea pig chicken to rat.

The development of plastic surgery as a specialty is in essence, the history of man s increasing facility in transplanting tissues especially skin The difficulty with plastic surgery is that it requires imagination according to Homans.

Baronio in 1804 may possibly have reported the first verified, nonclinical success at free skin autografting in Europe — nonclinical" because the actual grafting technic was performed at Baronio s suggestion by a charlatan. Baronio conclusively demonstrated that full thickness skin autografts could be transplanted successfully He cut two pieces of skin of equal size and shape without any subcutaneous fat

(2) S. Clin. North America 39 289-311 April, 1959

from opposite sides of the base of a sheep's back in the tail region and immediately cross-transplanted them to their correspondingly opposite defects Eight days later, the dressings over these grafts were removed and the grafts were normally healed in place.

In 1869 Reverdin observed in an ulcer case that epithelial outgrowth occurred from a spontaneously appearing island of epithelium in the middle of the ulcer Reverdin's little grafts are often called pinch grafts

Use of Three-Tailed Fascial Sling with Pull-out Wires to Correct Blepharoptosis is described by F A. Garcia and S E Blandford[3] (Denver)

TECHNIC.—The procedure is carried out under general anesthesia ne eye is operated on at a time. The fascia to be used is obtained from the tensor fascia lata of the thigh and cut to the desired shape. The body of the graft should be about 2 cm. wide and 0.75 cm. in vertical height, with tails about 3 mm. wide and 4 cm. long The tarsal plate is exposed by an incision 3-4 mm. above the eyelid margin and the body of the three-tailed sling is sutured to it in such a manner that about the upper half of the plate is covered by the body of the sling For suturing the fascia to the tarsal plate, 5-0 silk is used on the upper and lower margins. The stitches along the upper margin help to produce a normal eyelid fold and prevent eyelid eversion.

Three small incisions are made just above the eyebrow and with the Frackelton fascial-sling passer the tails are brought deep to the orbicularis oculi and out through these incisions. A loop is made at the end of each tail by folding back and suturing the tip of each piece of fascia. The pull-out wire is passed through this loop and the wire with the attached fascial tail is passed through the frontalis muscle, with the wire coming through the skin in the hairline. After surgery the eyelid is dressed in closed position. On the 2d or 3d postoperative day after the swelling has subsided, the height of the eyelid margin is adjusted by tightening or loosening the attached wires.

To prevent corneal damage, 0 5% methyl cellulose solution is used during the day and a bland ointment at night. The eyelid height is checked twice daily and suitable adjustments made during the 3-7 days after surgery The pull-out wire is not removed until the tails are well adhered to the frontalis muscle.

► [The authors have presented a technic with refinements for the correction of blepharoptosis. This procedure is a decided improvement over the procedure which utilized individual fascial strands to be anchored immediately above the eyebrow More accuracy and better cosmesis result. —Ed]

Uses of Bovine Bone in Reconstructive Surgery were studied by N Georgiade R. Woolf F Richard and K. Pickrell[4] (Duke Univ) Initially a series of dogs was used. Bony de-

(3) Plast. & Reconstruct. Surg. 23 596-600 June, 1959
(4) Ibid. 24 11-18, July 1959

fects of varying sizes were created in the mandible and filled with autogenous or bovine bone paste Serial histologic sections showed rapid new bone formation where bovine paste was used being comparable to that observed with autogenous bone

After the initial success on an experimental basis, a group of patients was selected who had cystic areas of the mandible or maxilla. After total removal of the cysts the bony defects were filled with bovine bone paste. Postoperative x ray studies revealed rapid bony consolidation in the cystic cavities. Varying degrees of localized reaction occurred manifested by edema and fluid formation at the operative site Cultures were uniformly sterile and the reaction gradually subsided in 4-7 days This reaction probably represented a sensitivity to the bovine serum in which the paste was stored

The program was expanded clinically and other bony defects including posttrephine skull defects posttraumatic facial defects mandibular fracture sites and alveolar cleft defects were packed with bovine bone paste. Successful filling of these defects was obtained though again a localized reaction often occurred necessitating aspiration of fluid Healing in all of the patients proceeded satisfactorily after aspiration The longest postoperative evaluation in this series was 24 months without any evidence of resorption or loss of contour being noted

A series of patients needing some type of solid bony support was then included Bovine rib or mandible was used as grafting material. All implants were carefully rinsed with saline and if the patient was not sensitive to penicillin were soaked in a penicillin solution (1 000 000 units) before insertion Uniformly successful results were obtained in these patients with no localized tissue reaction being noted A large mandibular defect was successfully bridged with a solid piece of bone 4 cm long X rays obtained 5 months postoperatively showed the original graft in place with apparent solid clinical union between the bovine bone graft and the adjacent bone It has been 1 year since insertion of the bovine bone implant. Infraorbital struts of bovine bone were used satisfactorily in 2 patients and a supraorbital posttraumatic defect also was successfully recontoured

► [Before accepting bovine bone as a substitute for the patient's normal tissue, one should recall the many instances in which foreign body substi

tutes were accepted with enthusiasm only to find after close observation that the material was later rejected by the body tissues or absorbed. The patient's own tissues are still the most desirable for grafting.—Ed.]

Differentiation of Human Fetal Skin Following Heterotransplantation was studied by George W. Hambrick, Jr., and Rosalyn Bloomberg[5] (Univ. of Pennsylvania). Several workers have successfully transplanted human embryonic tissues to small animals with or without prior conditioning of the recipient animal. This adaptability of fetal skin contrasts sharply with that of normal adult tissue, though some have claimed that adult tissue also grew readily under similar conditions. The reasons for the difference in behavior of fetal and adult skin remain conjectural. Fetal tissues are probably not antigenically mature at the time of implantation. However, this hypothesis remains unsubstantiated because differences in antibody formation specific for such tissues have not been demonstrated.

The authors found that human fetal skin from 8 of 20 fetuses on transplantation to the hamster remained viable and differentiated into normal, adult-appearing skin histologically. This skin consisted of the usual proportions of cells found in normal skin.

The primary eccrine sweat gland germ develops into an adult eccrine gland structure. It is unlikely that it functions in this abnormal environment. Presence of glycogen within its secretory cells indicates the possibility of functional capacity.

Primary epithelial germs produced coarse, hyperpigmented hairs that were shed into the epidermal cyst cavity. The hairs were in various stages of growth and development. Sebaceous glands of normal histology developed with glycogen in the peripheral cells. Lipid material filled the follicular funnels and the cysts.

The dermis, embryonic at time of implant, became adult in nature with the formation of normal-appearing reticulin fibers, collagen bundles and elastic tissue. The epidermo-dermal junction likewise develops normally, staining intensely with the periodic acid Schiff technic.

The significance of viability of fetal skin on homologous transplantation in clinical medicine remains problematic. It is doubtful, though early experiments using fetal skin in

(5) J. Invest. Dermat. 33:177-184, October, 1959.

adults are encouraging that such skin will be permanently viable in adult human hosts Toolan and co-workers were impressed with the viability of embryonic skin when transplanted to seriously burned patients They pointed out that small amounts of skin rapidly extend to cover a rather large denuded area This could conceivably be a temporizing measure under certain circumstances Recent experience using embryonic bovine skin in adult burned patients has been reported successful as a temporary measure.

Plastic Repair of Female Perineum in Case of Exstrophia of Bladder was carried out by John B Erich[6]

Girl 18, had bilateral ureterosigmoidostomy followed by surgical removal of the remnant of vesical tissue on the anterior abdominal wall. On examination the vaginal introitus was in evidence and was

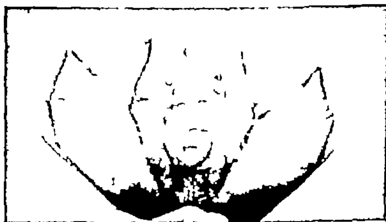


Fig. 206.—Deformity of vulva and perineum due to exstrophy of bladder Bilateral ureterosigmoidostomy had been done and a remnant f bladder tissue excised. Pedicle flaps of hair-bearing skin are outlined. (Courtesy of Erich, J B. Proc. Staff Meet. Mayo Clin. 34:235-237 Apr 29 1959)

associated with a normal vagina and cervix (Fig 206) The labia majora were absent, but some remnants of labia minora were visible just below and lateral to the vaginal opening The region of the mons pubis showed scarring and a contracted skin graft. Because the patient was extremely sensitive about the abnormal appearance of the perineum, a reconstructive operation was thought advisable.

Two pedicle flaps of hair-bearing skin were outlined in the groins, each flap having its pedicle directed posteriorly (Fig 206) After these skin flaps were elevated (Fig 207) the scarred and skin-grafted zone above the vaginal opening in the region of the mons was excised. Subsequently the flaps of skin were brought around the remnants of the labia minora and vaginal introitus and were approximated with fine silk sutures in the midline (Fig 208) While being transferred, the flaps were folded longitudinally on themselves to resemble the

(6) Proc. Staff Meet M yo Clin. 34 235-237 Apr 29 1959



Fig. 207.—Pedicle flaps of hair-bearing skin are elevated in each groin, and scarred tissue above vaginal opening has been excised. (Courtesy of Erich, J. B.: Proc. Staff Meet. Mayo Clin. 34:235-237, Apr. 29, 1959.)



Fig. 208.—Flaps are transferred and sutured around vaginal opening and remnants of labia minora. Donor sites in groin are closed by approximation of skin edges. (Courtesy of Erich, J. B.: Proc. Staff Meet. Mayo Clin. 34:235-237, Apr. 29, 1959.)

labia majora. In addition, it was possible to suture together the cutaneous edges of the donor sites from which the flaps were elevated, thus eliminating all raw surfaces.

Healing occurred promptly. As hair grew in the transferred flaps of skin and as the scars smoothed out, a fairly normal perineum in contour and appearance was obtained.

Observations on Therapy of Leg Ulcers The causes of leg ulcers may be listed, according to Raymond O Brauer[7] (Houston), as radiation, trauma or osteomyelitis, carcinoma, arterial insufficiency bacterial infection neurogenic, nutritional decubitus and stasis or venous ulcer

Conservative treatment is indicated for older age patients whose general body condition would not permit surgery or for those in whom the ulcer is relatively small early in the degenerative process and with minimal local fibrosis. Conservative treatment is also of value in obese persons who are on a weight reducing program

This treatment may include bed rest, with the affected leg elevated for 2-4 days cleansing of the area with pHisohex, and moist dressings Later a Contoura Elastoplast pressure dressing is applied

Exercise is advised When the ulcer is well healed a supportive dressing is applied consisting of an Ace bandage over an elastic stocking

At surgery excision of the ulcer is wide and should include not only the surrounding scarred borders but also some of the area of eczema and pigmentation The trend is toward greater and greater excisions The excision is performed under a pneumatic tourniquet and should extend down to and, if necessary include the deep fascia. This is especially important when the scar involves the fascia The perforating veins should be sought out and ligated After the tourniquet is released all bleeding points are ligated and any remaining avascular areas are excised The wound is dressed with a thick Furacin gauze and Kerlex pressure dressing and the patient is returned to the operating room in 1 week Experience has shown that though the bed may have appeared viable at the primary excision certain areas have turned white and are avascular when the patient is returned to surgery in 1 week This has accounted for the areas of loss after primary grafting had been done further complicating the treatment and such areas were often the site of secondary breakdown

At the second operative procedure if the bed is avascular further excisions are performed and the leg redressed The patient is returned to the operating room in 5 7 days and if

(7) Journal Lancet 79 435-441 October 1959

a clean granulating tissue bed has formed, the grafts are applied A thick split graft is taken

► [Excision of the deep fascia should be effected in all cases of leg ulcer with lymph stasis and extensive fibrosis. Subsequent to this, an immediate skin graft may be applied, and improved lymph drainage will occur in the entire lower leg through anastomosis between the deep lymph circulation and the superficial.—Ed.]

Median Forehead Flap—Indications and Limitations. According to *Frederick A Figi and Warren L. Moorman Jr*[8] (Mayo Clinic and Found) the principal indications for the median forehead flap include loss of full thickness skin of

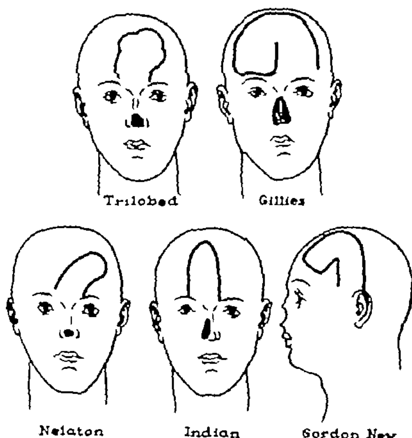


FIG 209 —Some forehead flaps more commonly used in repair of facial defects. (Courtesy of Figi, F A and Moorman, W L, J Plast. & Reconstruct. Surg 24 163-174 August, 1939)

up to one half of the surface area of the nose through and through defects of the nose, defects of the nasal tip alar defects loss of skin from the medial halves of the upper and lower eyelids, short nose in which elongation requires additional full thickness skin and lining defects of the nasofacial

(8) Plast & Reconstruct. Surg. 24 163-174 August, 1939

angle down to the level of the ala, restoration of the lining of the nasal fossa rotated flap for repair of soft tissue defects in other areas of the forehead repair of the columella and at times the upper lip and use of such a flap stripped of epidermis (filleted) as a vascularized soft tissue filling for supraorbital nasal or nasofacial depressions.

A limitation rather than an objection to the method is the size of flaps obtainable within the limits set by the desire to close the donor wound immediately Perhaps for the average adult person 4 or 5 cm ×7 9 cm would be the upper limits in size obtainable These limits require careful appraisal in each patient because the skin of the forehead in young adults is much tighter and permits less stretching than does the skin of an elderly person A receding hairline is a real advantage in this respect i e. the flap can be made obliquely rather than vertically so that considerable increase in length is obtainable so much so that a flap long enough for repair of the upper lip often is readily feasible Additional lengthening also can be obtained by incising downward through the brow and freely mobilizing the tissues well down onto the root of the nose By use of the Schimmelbusch closure method, as described by Kazanjian a width of as much as 5 cm at the hairline can be obtained readily This method involves the formation of two large scalp flaps that are rotated forward and medially (Fig 209)

The advantages of the median forehead flap are the color and texture of the skin match well those of the nose and adjacent skin the flap can be elevated and transferred in one stage the flap can be severed and the base fitted down in a second stage within 16-18 days the donor wound can be closed directly in practically all cases in which this method is indicated the patient is spared the necessity of maintaining awkward uncomfortable positions and incidence of delays sloughs and failures is minimal

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BURNS

Treatment of Burns is described by Michael L. Mason[9] (Chicago) The care of burns may be divided into four phases The initial phase starts with onset of the burn con

(9) Nebraska M J 44 10 14 January 1959

tinues through the initial treatment, local and general and carries the patient through the initial 48 hours The second phase starts on or about the 3d day and continues for 6 days or so until the time of initial dressings or, in the case of open treatment, until areas of full thickness loss become manifest The third phase picks up from here and continues until the burn is entirely healed and would include skin grafting procedures if necessary The final phase or phase of rehabilitation continues from the final healing until the patient is restored to maximum function. This includes local rehabilitating procedures e.g , scar excision, skin grafts and other measures necessary to return the patient to useful work.

First-aid care of the burn consists simply in covering it as soon as possible with a sterile dressing or clean cloth and getting the patient to a place where proper treatment can be rendered. Local care of the burned area should be rendered under aseptic conditions in an operating room or in a properly arranged emergency room The burned surface is first cleansed gently with warm water and soap and thoroughly rinsed with warm sterile saline solution. If the burn is extensive, it is well to have 2 or 3 persons carrying out the washing to accomplish it within a reasonable period. Each burned area should receive about 10 minutes of careful washing After this fresh gloves are donned and a so-called debridement of the burned surface is carried out. This consists simply in removal of loose skin tags unroofing of vesicles and removal of debris After debridement, the surgeon decides on the nature of care If open or exposure treatment is elected the patient is put to bed under a sterile tent to await coagulation of surface secretions. If however closed treatment is elected the burn surface is first covered with a single layer of fine mesh gauze

Dressings are changed about the 5th to 8th day usually just down to the fine-mesh gauze Slough can be removed by various methods Mason prefers surgical removal of the slough Excision is carried out under general anesthesia. Grafting is seldom done at the time of excision

Essentials of Burn Therapy are described by Curtis P Artz and Byron E. Green[1] (Univ of Mississippi) Tracheostomy usually can be performed after pain has been alleviated

(1) S Clin. North America 38 1461 1474 December 1958.

and replacement therapy initiated but the need for it can be determined while the history is being obtained

Venous blood samples are drawn for cross matching and other determinations Then Dextran or lactated Ringer's solution can be given through this needle until a cut-down cannula is in place Morphine can be given through the same venipuncture needle.

When burns involve more than 25% of the body surface, an indwelling catheter is needed for accurate measurement of urinary output Patients with serious burns of more than 25% of the body surface should also have an intravenous cannula tied securely in a vein

Care of the burn wound should be performed in a clean dressing room Aseptic technics should be carried out with those in attendance wearing masks and sterile gloves In definitive local care the exposure method may be used if the burn is of such configuration that it can be easily and adequately exposed and immobilized. After the initial cleansing the patient is placed in bed on a clean nonsterile sheet in the most comfortable position that completely exposes the affected areas Occlusive dressings should be used in all burns in which the exposure method is not applicable.

In patients with burns not exceeding 15% of the body surface, when there is definite evidence of full thickness injury immediate excision of the damaged tissue may be performed during the first 2 or 3 days postburn followed by grafting 4 days later

In patients with minor and moderate burns prophylactic antibiotic therapy is not essential Antibiotics should be given only after evidence of infection In patients with more serious burns routine antibiotic therapy should be started on hospitalization.

Previously immunized persons should be given a booster dose of 0 5 cc tetanus toxoid. If the period since the last injection of toxoid is more than 4 years tetanus antitoxin should be given in addition to the toxoid booster

Most minor burns can be treated by oral fluids. In most severely burned patients however paralytic ileus develops early and vomiting may result It is usually safer in a seriously burned patient to give all fluid replacement intravenously The depth of the burn influences the type of fluid therapy particularly in the colloid requirement Patients

with 2d-degree burns who have an appreciable amount of 3d-degree injury should be given colloid as Dextran and blood in equal amounts One of the great dangers of early fluid therapy is excessive intake

The acceptable methods for removal of eschars are repeated change of dry dressing wet soaks and surgical excision Their use depends on the extent and location of the burn.

Split thickness skin grafts should be applied to a 3d-degree burn area as soon as the eschar is removed and the recipient site prepared Despite the fact that all granulating tissue is contaminated skin grafts will take unless the area is unusually purulent or group A beta hemolytic streptococci are present. Three methods of applying skin grafts may be used lay-on methods postage-stamp method and suture method. If adequate skin is available the best method for applying split thickness grafts to large flat surfaces is by the lay-on method

Renal Function in Burned Patients and Its Relationship to Morphologic Changes I G Graber and S Sevitt[a] studied renal function in 17 extensively burned patients who had been hospitalized and treated by intravenous therapy ½ 3½ hours after burning and was related to the renal histologic changes in those who subsequently died Patterns of glomerular and tubular function were established from examination of the serial specimens of urine hourly at first and of appropriate blood samples From these, estimates were made of the glomerular filtration rate (creatinine clearance) urea clearance plasma creatinine and urea levels and of the excretion of water sodium potassium and chloride.

Nonselective back diffusion was found to play no part in the composition of the urine in patients with acute renal failure and therefore the glomerular filtration rate could be measured by creatinine clearance. The glomerular filtration rate fell considerably during the first few hours after burning even though transfusion with plasma was most intense at this time In some patients mainly children recovery occurred in 24-72 hours and azotemia was absent or moderate and temporary In others mainly adults the low glomerular filtration rate persisted or even worsened until death supervened in them azotemia was considerable severe oliguria

( ) J Clin. Path. 12 25-44 January 1959

sometimes developed but more often the urine flow was normal near normal or even polyuric.

Diminished tubular reabsorption of water was found in oliguric and nonoliguric patients with severe azotemia. When this balanced the low filtration rate the urine flow was normal whereas oliguria occurred when the fall in the glomerular filtration rate was greater

Similar patterns of tubular activity (including the maximal power to reabsorb sodium and chloride and to excrete high levels of potassium and a tubular ability to differentially handle urea creatinine water and electrolytes) were found in patients whether or not they had azotemia, a persistently low glomerular filtration rate or oliguria. Similar tubular activity was found in survivors and in those who died with proximal or distal tubular necrosis or without tubular necrosis

The results conflict with the concept that acute renal failure is characterized by loss of tubular function that it is due to renal tubular necrosis and that severe oliguria or anuria is always present The major dysfunction is glomerular and not tubular even though tubular necrosis and blockage by cases are often found

It is commonly believed that there is no histologic abnormality of the glomerulus that can explain acute renal failure, but the finding of many fine fatty droplets in the glomerular epithelium and possibly in the endothelium of the tuft makes reconsideration of this belief necessary Studies by electron microscope of the normal glomerulus have shown that the capillary endothelium is full of fine pores and that the epithelium has multiple fenestrations between fine foot like projections cemented to the basement membrane. This indicates that the only glomerular structure capable of acting as a filter is the basement membrane It is worth speculating whether subtle glomerular changes difficult to define in ordinary histologic sections such as acute swelling of the epithelial or endothelial cytoplasm, may be present in patients with a persistent fall in the glomerular filtration rate. Such changes would reduce the porosity of the cells apposed to the filtering membrane. In this connection the appearance of fatty droplets in the epithelium may be a histologic sign of a more serious and subtle change affecting filtration

Serum Protein Changes in Thermal Trauma I Electrophoretic Analysis at pH 8 6 Gerard F Lanchantin and Ruth Edwards Deadrick[3] (Brooke Army Med Center) studied the quantitative changes in the serum electrophoretic pattern of 28 patients who had thermal injury The methods used included moving boundary and filter paper electrophoresis at pH 8.6 The latter technic was more adaptable to this type of study

After thermal injury that had a burn index of below 10 there was little evidence that any pronounced or definite change occurred in any of the serum components With a burn index of over 12 however the pattern presented with time postburn appeared to result irrespective of the area or severity of the injury

No particular relationship was noted between the extent of hypogammaglobulinemia after injury and predisposal or occurrence of septicemia Though there was some evidence (4 patients) that septicemia occurred at a time of hypogammaglobulinemia, the data were insufficient to permit any conclusion Reduction in gamma globulin after injury occurred to some extent in every patient with a burn index over 10 and this phenomenon may be the result of a shift in the compartmentalization of this component.

No alteration was noted in the beta globulin component after injury However the lack of any observed change in this component may be due to the method of analysis used The shifts in gamma globulin after burns can be explained on the basis of shifts in body water and to some extent dilution Certainly this is the most obvious answer The relationship between the gamma globulin level and septicemia is not clear Only a small percentage of gamma globulin represents antibody protein and burn patients have a normal total body gamma globulin though of different distribution from that found in healthy persons

Nutritional Response of Burned Child was studied by Anne B Sutherland[4] Weight loss occurs in a burned child despite the ingestion of the recommended or of a higher intake of protein and calories The severity of the weight loss is related in part to the extent of the injury and continues for 2-4 weeks

(3) Clin. Invest. 37 1736 1 45 December 1958
(4) Roy Coll. Surgeon Edinburgh 4 149-152 January 1959

Weight loss is not the result of starvation unless it is postulated that relative starvation exists because of an increased requirement. Though exudate loss may play some part, the most severe weight loss occurs in many patients before exudate loss is maximal.

There are three phases in the weight chart—(1) weight loss (2) fluctuation around the lowest weight or of slight gain and (3) rapid gain. High intakes of protein and calories can reduce the severity of the weight loss and perhaps also its duration in the first phase. In the second phase, if intake drops from this high level the start of weight gain will be delayed In the third phase, high intakes are associated with rapid gain and after the gain is firmly established it will usually continue even when intake is reduced Therefore there appears to be a definite catabolic phase after burns. Whether this is obligatory catabolism of lean tissue or of fat, or of both, is not possible to state.

A nutritional scheme that uses the child's admission weight in pounds and the percentage of burn is suggested. This formula is applicable to all ages and to all degrees of injury and allows a protein intake of 1 5 Gm./lb plus 1 Gm./percentage of burn and calorie intake of 30/lb plus 30/percentage of burn

Electrolyte and Fluid Therapy in Burned Patients is evaluated by Claude R. Hitchcock[5] (Minneapolis) The aim regarding initial replacement therapy probably should be to compensate for the large abnormal losses and translocation of circulating fluid electrolyte and protein prevent hyponatremia and undue concentration of the red cell mass and maintain the patient at a slightly reduced level of serum sodium tending to prevent pulmonary edema. Because many burn patients have more or less tracheal bronchial irritation from hot gases and therefore are predisposed to pulmonary edema, the last mentioned consideration is important for optimum management of serious cases. The original Evans formula can guide replacement therapy most adequately and safely The author s basic replacement therapy for adults includes colloid 1 cc./1% burned/kg weight (one third to one half of this amount as whole blood) electrolyte, 0.75-1 cc./1% burned/kg weight and dextrose in water 1,000-2 000 cc.

(5) Minnesota Med 41 862-867 December 1958.

The most satisfactory gauge for the adequacy of fluid replacement during the first few days after the injury is hourly recording of urinary output. Fluid replacement can not safely be determined by elevations in serum hemoglobin and hematocrit values If the patient is quickly mobilized to a hospital for treatment and fluid therapy is started immediately adequate hourly urinary output can usually be maintained.

If the initially planned fluid and electrolyte therapy for the severely burned patient does not result in adequate urinary output by the end of the first 24 hours fluid replacement can be assumed to be lagging behind bodily needs in terms of edema and excessive losses Increasing the intravenous intake of fluid and plasma will usually correct the deficit and adequate urinary output will result

Patients who are inebriated at the time of the burn trauma respond poorly to therapy during the immediate postburn period.

Undoubtedly an occasional patient may demonstrate renal failure without apparent cause but most early deaths after severe burns can be attributed to a replacement therapy that is inadequate in terms of quantity and composition of the balanced replacement.

Burn Following Accidental Exposure to High Energy Radiation. Lester M Cramer John H Waite John H Edgcomb Clinton C Powell John H Tuohy Eugene J Van Scott and Robert R. Smith[6] (Nat l Inst. of Health) studied clinically and histologically the skin changes in a man aged 32 who was accidentally exposed for a few seconds to the beam of radiant energy from a Van de Graaff accelerator The total electron dose was about 7,200 rep at the point of highest exposure. Total dose of penetrating x ray did not exceed 100 r and was probably in the range of 50 r or less It can be assumed that the soft x rays did not add appreciably to the total radiation dose already present from the beam of electrons The primary beam covered an area about 6 in in diameter

No symptoms attributable to the acute radiation syndrome were observed. From experimental knowledge and clinical experience no such effects were expected because the elec-

(6) Ann. Surg 149 276-293, February 1959

trons of the energy involved here are almost 100% absorbed by 3-6 mm of tissue

During the first 40 days the patient had anemia and hypoproteinemia which, in absence of lymphopenia were believed to be due to the chronic infection and seepage from the open wound The type of anemia (microcytic hypochromic) was consistent with this

The patient s skin response to the electron injury was the initial phase began with a burning sensation at time of exposure followed after an interval of minutes by the appearance of erythema This redness deepened over 2 weeks and the involved area became extremely pruritic at its periphery In the region of the most intense irradiation the erythema was obscured by intracutaneous edema The second or exudative phase began on the 10th day with the appearance of vesicles in the area of the most severe exposure. This area progressed through a bullous stage and drained within 2 weeks However concentric areas of vesiculation continued to appear centrifugally with the result that tissue damage was evident in marginal areas only after 10 weeks Necrosis became apparent in the central zone by the end of 3 weeks representing the beginning of the third phase. Necrosis of outer zones occurred later in a sequence similar to the delayed appearance of vesiculation in these areas By the 93d day the process of necrosis had ceased except in the area in the right groin, which persisted to the 122d day

Conventional open therapy as used for thermal burns was carried out The patient returned to full activity in 6 months.

► [This paper deserves study by all concerned with the care of burns. It is of special interest in affording further insight related to tissue changes following exposure to radiant energy —Ed.]

Burnt Hand Clifford L Kiehn and John D Des Prez[7] (Cleveland) emphasize that deformities from deep burns of the hand result from the sequence of edema infection suppuration and fibrosis This irreversible cycle must be broken by early proper treatment viz the use of adequate skin coverage

Prevention of the fixed burnt hand can best be accomplished by placing the hand immediately in a position of function elevation and occlusive voluminous pressure dressing This will prevent the formation of massive edema.

Infection cannot occur if the pellicle of crust and devital

(7) Am. J Surg 97 421 428 April, 1959

ized tissue is kept intact until replaced with a graft If the hand is seen late and the slough has begun to separate with the formation of granulation tissue, this process should be encouraged and assisted to acquire rapidly an ideal base to receive the split graft. If this process is prolonged, a layer of fibrosis is laid down under the granulation tissue The older the burn the more dissection must be performed for the graft to lie on a bed that will supply early subsistence. This bed or recipient site is on the fascia covering the extensor tendons This also holds true if a decision is made to excise and graft immediately

The hand is covered by a great deal more skin than is generally supposed A common error in use of a split skin graft is the belief that one full drum of skin will cover the dorsum of an adult hand To cover the entire area of the dorsum and fingers will require nearly two drums Two weeks after the graft has been applied motion should be started after which secondary surgical procedures may need to be carried out, such as Z plastics to the interdigital webs and capsulotomies

The authors advocate earlier grafting of the burnt hand than has been done in the past If there are no complications the best functional result can be obtained with excision and graft in one stage to prevent the invasion of bacteria and fibrosis This will also diminish the patient s hospital stay and decrease morbidity as well as eliminate the necessity of joint surgery

► [The authors discuss in a masterful dissertation the fundamentals involved in caring for the burnt hand Their discussion is basically sound and offers many helpful suggestions in the resolution of these problems. —Ed]

CONGENITAL ANOMALIES

Some Observations on Cause and Treatment of Harelip and Cleft Palate, Based on Treatment of 1 041 Patients are presented by Michael C Oldfield[8] The time to repair the nostril and lip in harelip is when the baby is thriving and weighs 12 lb or over An intratracheal tube should always be used to administer an anesthetic to a baby for a major operation Gas oxygen and ether on open circuit is the safest

(8) Brit. J Surg 46 311 321 January 1959

method Safety also depends on the child waking up immediately after the intratracheal tube is removed The anesthetic should therefore be light so that when the tube is removed at the end of the operation the child cries and expands the lungs

For unilateral complete harelip Le Mesurier s method is suggested A rectangular flap is made on the outer side of the cleft It is rotated through almost a right angle to provide full width at the vermilion border By this method a much better nostril as well as lip can be made. In incomplete harelip of minor degrees without nostril deformity, simple excision by Kilner s modification of Rose s method is all that is required Complicated flap operations are unnecessary

A bilateral harelip can be repaired in one stage If the premaxilla is tilted forward a small triangle of bone is removed from the junction of the premaxilla and prolabium to mobilize the central portion It is important when suturing to unite the junction of the vermilion and pink skin on each lateral element to a point a little distance lateral to the midpoint of the U that is made on the central prolabial skin No prolabial vermilion' is ever allowed to appear on the free border of the lip but the red mucosa on the prolabium is freed and allowed to slide backward and is used to form the lining of the undersurface of the central part of the lip

Among 530 consecutive patients operated on for repair of harelip deformities the operative mortality was 0.75% (4 patients)

The standard operation described by Wardill and Kilner for cleft palate surgery will yield standard and reasonably good results if the surgeon is careful Interference with the pharyngeal muscles by any form of pharyngoplasty is unwise in a primary case The most important phase in the operation for palate repair is to free the soft tissues widely from the cleft bone, then to unite the separated muscles and mucosa in the midline The floor of the nose should always be closed by suturing the nasal mucosa.

Reconstructive Surgery in Congenital Anomalies of Hand is described by Arthur J Barsky[9] (Albert Einstein College of Medicine) Operative procedures in themselves technically difficult, *are immeasurably more difficult in* the small

(9) S Clin. North America 39 449-46 April, 19[illegible]

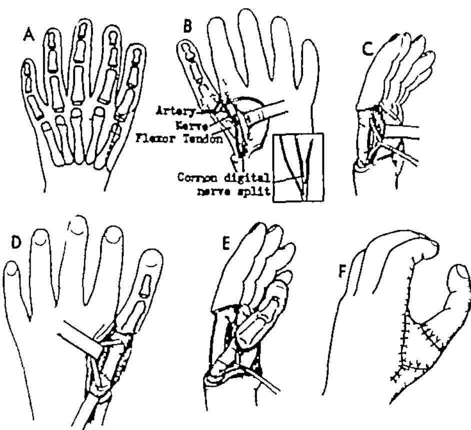


Fig. 210.—Transplantation of radial digit on neurovascular pedicle to serve as thumb (after method of Bunnell and Littler). Method described is one-stage procedure. *A*, incision, dorsal view; circumferential incision is made around base of radial digit. This is continued proximally on dorsum along metacarpal almost to its base, then curved around radial border of hand on to palmar surface. *B*, palmar view: flap has been dissected and reflected, exposing nerves and vascular supply to radial digit and to radial side of adjoining finger. Common digital nerve is split proximally, whereas branch of digital artery to radial side of adjoining finger is cut and ligated. This provides arteries on both sides of finger to be migrated. *C*, flexor and extensor tendons are retracted. Dotted lines indicate direction of bone incision; stippled area shows portion to be excised. Angulation must be carefully planned. *D*, dorsal view. *E*, digit is rotated on its neurovascular pedicle into position of opposition and metacarpal pinned with Kirschner wires. Tendons are not shortened, but muscle bellies accommodate themselves. *F*, closure. If difficulty is encountered in closure, free graft may be used to supplement flap. (Courtesy of Barsky, A. J.: S. Clin. North America 39: 449-467, April, 1959.)

hand with its tiny and delicate structures. All operations should be carried out under a properly applied pneumatic tourniquet inflated to between 200 and 250 mm. Hg. The skin should be adequately padded to prevent bruising and the tourniquet deflated at the end of 1 hour. After a few moments it may be reinflated if necessary for a similar period. Without a tourniquet, proper operation and avoidance of injury to important structures are almost impossible. After the tourniquet is finally deflated, the bleeding vessels that cannot be

controlled by pressure should be ligated. The necessity for a stable skin covering cannot be overemphasized because the hand is a mobile organ subject to friction and exposure. Because so many of the hands require resurfacing, it is essential for the surgeon undertaking this type of work to master the principles of free transplantation of skin and flaps

The thumb is the most important and most useful digit in the hand In one type of thumb deformity the patient has a 5 finger hand the radial digit being triphalangeal The entire ray resembles the normal index finger and not a thumb and its metacarpal does not have the range of motion of the normal thumb metacarpal-carpal joint Thenar muscles are absent but extension and flexion are present This radial digit is aligned in the palmar plane with the other fingers and cannot oppose on the 2d digit In this type of deformity, the radial digit is almost as long as the adjacent finger This is regarded not as a hypoplastic deformity but as the replacement of the thumb by an ordinary nonopposable digit. If the radial digit is migrated on a neurovascular pedicle (Fig 210) an opposable thumb substitute can be obtained

In a similar type of thumb deformity the thumb has 2 phalanges and a metacarpal of normal length. In this type, as in the previous one the thenar muscles are absent but finger flexor and extensor muscles are present This is a nonopposable thumb It may be treated as shown in Figure 210

Restoration of the thumb in these conditions depends on how much of a digit the patient actually has i.e. on its size and also on its location and its voluntary muscular activity

► [Dr Barsky has revealed, through ingenious surgical procedures, the satisfactory restoration of many deformed hands. This is an excellent article for study by all who are engaged in hand surgery —Ed.]

NEOPLASMS

Xeroderma Pigmentosum Report of Case Treated by Total Resurfacing of Face Robert Woolf Joseph Kepes, Nicholas Georgiade and Kenneth Pickrell[1] (Duke Univ) observed a patient with rapidly progressing xeroderma pigmentosum.

Boy aged 3½ was perfectly well from birth until about age 1 year

(1) Plast. & Reconstruct Surg 24 214-217 August 1959

when freckles began to develop on the nose and cheeks Freckling persisted and progressed and at age 3 scales began to form on the freckles. Examination showed hyperpigmented areas 1-8 mm. in size over the exposed surfaces of the forehead, face neck, hands and anterior tibial regions. There was some scaling of the pigmented areas of the malar prominences with early squamous cell carcinoma of the right cheek, which was verified by biopsy The lesion was removed widely

He was hospitalized again at age 5 There had been pronounced progression of the pigmented scaling lesions over the greater part of the forehead and face. About 3 months previously a wartlike lesion had developed on the lower lip Examination again disclosed many hyperpigmented areas that had increased since the previous hospitalization. Also a 1-cm. squamous cell carcinoma was present on the lower lip. Because it was believed that more radical measures would be necessary not only to control the malignant lesion of the lip but also to prevent the premalignant lesions that were occurring on the face from progressing into true malignancies it was decided to excise and resurface the area of the face. The skin of the right cheek was excised and resurfaced immediately with a split thickness skin graft that was cut from the left thigh Pathologic studies of the skin removed from the cheek showed multiple basal cell carcinomas. The lesion of the lower lip a squamous cell carcinoma, was resected widely At the end of 1 year it was believed that the grafted area had held up surprisingly well Though there were many new carcinomas developing in the ungrafted areas of the face, there were no lesions in the grafted area. Because the development of new carcinomas on the forehead, eyelids, nose lips chin and cheek was progressing and extending with alarming rapidity total resurfacing of the face was deemed a procedure of imminent necessity

At age 6 total excision and resurfacing of the rest of the face was performed in four operations using split thickness grafts from both thighs. About 9 months after total resurfacing of the face, a marble sized, firm, submandibular mass was found in the left neck. The mass showed no evidence of carcinoma.

► [Facts presented in this case report serve to show the insidious nature of this disease. Much research deserves to be done in an effort toward solving this problem.—Ed.]

Primary Mucoepidermoid Carcinoma of Skin Report of Case is presented by H Stephen Gallager George V Miller and Giuseppe Grampa[2] (Univ of Texas)

Woman, 54 had mucoepidermoid carcinoma of the skin of the foot (Fig 211) The lesion eventually produced death by widespread metastasis. The histologic structure of the tumor was that of an epithelial neoplasm composed of two cell types. One type, a cell closely resembling that in squamous carcinoma, was variable in size and polyhedral in shape, with scant homogeneous eosinophilic cytoplasm and a well defined cell border Nuclei while variable were generally large an vesicular with prominent nucleoli and peripherally con chromatin. Mitotic activity was more prominent in these cells than

(2) Cancer 12:286-288 Ma Apr 1959

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(2) Cancer 12:286-288, M Apr., 1959

cells of the second type but it was not outstanding in either type. Keratohyalin was not produced. Intimately commingled with these cells were other larger cells characterized by clear or finely granular cytoplasm without inclusions and by small compact nuclei with irregular outlines. Graduations in character between the two types could be readily demonstrated suggesting common origin The two elements were arranged in an indistinct lobular pattern in some areas suggesting abortive gland formation. The smaller cells usually occupied



Fig 211 —Appearance of tumor (Courtesy of Gallager H. S et al Cancer 12:286-288, Mar Apr 1959)

the peripheries of lobules, and the granular cells usually occupied the centers. There was no significant variation among the various nodules, except that granular cells were less numerous in the metastases than in the primary tumor Because of the ulceration at the primary tumor site, the relation of the tumor to the epidermis was difficult to determine however the tumor was in proximity to marginal skin remnants. No association with underlying tendinous fascial or other supportive structures was shown.

The tumor was assumed to have originated from a sweat gland.

Hemangioma Thrombocytopenia Syndrome seems to be a definite entity according to F X Paletta J Walker and J King[3] (St. Louis Univ) Of 11 cases previously reported in the literature in 3 instances there was normal platelet

(3) Plast & Reconstruct. Surg 23 615-620 Jun 1959

count during the prepurpuric phase Platelet counts were not taken in all of the patients before the purpuric episode Before the purpuric phase there was evidence of normal blood clotting in 3 There was no bleeding from circumcision in 2 patients and an incision and drainage into the hemangi oma produced no unusual bleeding With occurrence of the purpura which was confined to the tumor site and neighbor ing area there was always an associated thrombocytopenia When the tumor regressed the platelets returned to normal This time varied from 6 weeks to several months

There has been no uniform explanation of the pathogene sis of this condition and the lack of complete understanding of the biologic behavior of platelets is not helpful However it is apparent from study of the reported cases that the hemangioma thrombocytopenia syndrome is not related to essential thrombocytopenia purpura for these reasons sple-nectomy has not corrected the continued platelet sequestra tion and the platelet count has returned to normal after the tumor regressed

Interpretation of the megakaryocytes in the bone marrow is difficult because there are two processes going on at the same time there is loss of platelets trapped in the heman-gioma and accelerated platelet production going on during the purpuric phase. Immature megakaryocytes would be ex pected in the bone marrow however they were normal in the authors patient. This is similar to what others have found. Southhard and associates have suggested that the se questration utilization and destruction that occur in the he mangioma produce an increased demand for platelets and because the limited reserve of these young children cannot meet this demand thrombocytopenia results

Because large hemangiomas in the newborn are precursors of thrombocytopenia purpura early removal by surgery is advisable. Patients treated by x ray therapy have shown re-currence of the purpura because of persistent hemangioma.

► [Facts submitted in these case reports afford ample evidence to contra dict the theory accepted by some that nothing should be done for obviously growing hemangiomas.—Ed]

Middle Third Facial Tumors Clifford L. Kiehn and John D Des Prez[4] (Cleveland) observe that after diagnosis of midfacial tumor has been established the decision as to

(4) Plast. & Reconstruct Surg 24 137 149 August, 1959

the best treatment for the particular lesion and patient is not always unequivocal Primary nasopharyngeal tumors usually cannot be treated surgically because the growth is usually well advanced before diagnosis is made and access to the lesion is difficult or impossible. The primary tumor generally is treated by radiation and surgical removal of the neck nodes Prognosis is usually poor and in late stages the patient has severe pain

Radical surgery is necessary for malignant tumors of the maxillary sinus and maxilla with complete exenteration of the maxilla, including the lateral wall of the nose ethmoid and sphenoid sinuses and often the orbital contents Except in extremely limited disease the palate is included in the resection, and bone in this region must always be removed. Some tumors of the maxilla of dental or sinus origin are locally destructive but do not metastasize. These must be totally removed but do not require radical resection of surrounding tissue.

Because resections must be individualized according to the area involved and the type of neoplasm each reconstruction must be planned according to the requirements of the surgical defect, the patient s age and general condition and the prospect of cure of the malignant disease. As far as possible reconstructions are accomplished with autogenous tissue but this must often be supplemented by various prostheses Such cases usually involve lining the surfaces with skin from a hairless area such as the lateral chest wall bone grafting the jaw and floor of the orbit to bring the eye (when it does not have to be sacrificed) into normal position construction of dental prostheses and use of partial facial prostheses

Carcinoma of the maxillary sinus is the commonest tumor of this region with fatal results Generally prognosis is poor, and cure can only be more readily assured if the lesion is localized in the dental alveolus and quickly recognized Treatment is usually surgical resection because x ray therapy is not indicated in bone invading tumors

► [The authors have clearly shown that lives of patients suffering from extensive and advanced cancer of the face are worth fighting for All too frequently similar cases are relegated to a group classed as inoperable rather than subject the patient to a massive excision. Far too many examples of success exist in the records for these cases to be by-passed. —Ed.]

Scalp Flap Reconstruction in Head and Neck Cancer Patients was carried out by Claude C Coleman, Jr[5] (Univ of Virginia Hosp) Extensive cancers of the scalp skull and maxillofacial skeleton offer many surgical problems It has been pointed out that most of these patients received previous insufficient surgery or an overabundance of radiotherapy or both Such inadequate treatment greatly increases the magnitude of the definitive resection

Block removal of these tumors has further magnified the problem of wound closure The field of resection has included the skull or facial bones in all of the author s patients In 2 the dura and major vessels at the base of the skull were left exposed in the field of resection The urgent need for pedicle flap coverage in such patients is obvious

The use of large undelayed rotation scalp flaps has afforded the necessary healthy tissue for wound coverage at the time of tumor removal Their use was restricted to patients whose wounds could not be closed by simple advancement of the skin to the mucous membrane by judicious use of free skin grafts or those in whom vital structures were left uncovered by healthy soft tissues Though the pedicles of these large flaps have been located near the terminal arborization of the external carotid artery their blood supply has not been clearly defined in all cases In a boy 5 with sarcoma of the pterygoid fossa the entire carotid system on the side of the rotation flap was resected. The arterial blood supply would have to be over one of two routes from the opposite occipital artery or through the anastomoses between the muscular branches of the vertebral artery and the occipital artery on the same side In this patient venous drainage through the superficial temporal veins was intact. However in patients who require radical neck dissection venous drainage is seriously impaired and the external carotid system may be damaged as well. Perhaps this fact explains the partial losses that have been observed in such flaps

The cosmetic results from use of these large hair bearing rotation flaps is anything but ideal Though cosmetic result is always of great importance Coleman is far more concerned with affording immediate soft tissue coverage to wounds that often extend to the meninges Another advan-

(5) Plast. & Reconstruct. Surg 4 45-52 J ly 1959

tage of these flaps is that immediate postoperative radiation may be started when indicated After the patient has been followed for an arbitrary period these scalp flaps may be returned to their normal location and the defect filled with a flap from a distance

Rational Treatment for Advanced Cancer of External Ear and Temporal Bone is described by Claude C. Coleman, Jr., and Afif Khuri[6] (Univ of Virginia Hosp) Application of the principles of block resections for cancer of the head and neck applies to the treatment of advanced cancer of the external and middle ear The sacrifice of contiguous structures without regard for facial symmetry in conjunction with a homolateral neck dissection is mandatory to eradicate the soft tissue extension of the tumor Subtotal resection of the temporal bone en bloc is accomplished by extradural approach through the temporal squama thereby exposing the petrous pyramid as far as the internal acoustic meatus After unroofing the sigmoid sinus the block resection of the temporal bone can be effected as described by Parsons. The necessity for en bloc neck dissection is predicated on presence of clinically involved lymph nodes

In the patient reported by the authors a man 75 no associated neck dissection was performed because the digastric lymph nodes were negative by frozen section The use of a large rotation scalp flap permitted primary wound closure thus obviating the troublesome complications associated with open wounds of this magnitude and location

All malignancies of the ear are locally invasive and metastases to the regional nodes occur relatively infrequently and late in the disease Cancers of the external ear generally spread endocranially Surrounding structures are often involved and occasionally the patient presents with partial facial paralysis Death results from hemorrhage infection or inanition

The greatest single cause for failure in the surgical treatment of these tumors has been inadequate piece meal removal resulting in a prohibitively high local recurrence rate

► [The authors summarize in an effective manner the reasons underlying the extremely high mortality associated in the management of these cancers Procrastination, mismanagement and inadequate removal of tissue are largely responsible for failures Stress is properly placed on the importance of selecting a capable surgeon who, through experience and

(6) Virginia M Month. 86.21-24 January 1959

knowledge, directs his efforts toward complete and adequate eradication as soon as possible.—Ed.]

Clinical Characteristics of Some Tumors of Skin are evaluated by Harold O Perry[7] (Mayo Clinic and Found) The tumors of dermal appendages are perhaps the most interesting among the whole range of skin tumors Syringomas are uniform sized red to brown papules grouped over the arms



Fig. 212.—Tumors of skin appendages. A, syringoma, sweat-gland tumor clinically resembling lesions of lichen planus. B, cylindroma presenting as lesions about hairline and referred to as turban tumors. C, adenoma sebaceum involving face. D, trichoepithelioma, characterized by minute, pearly papules that involve central portion of face. (Courtesy of Perry, H. O.: Wisconsin M. J. 58:99-106, February 1959.)

and trunk (Fig 212 A) They appear early in life and most often in girls The individual lesions are asymptomatic and their resemblance to the papules of lichen planus is often commented on. Histologically it is thought that these tumors arise from the sweat ducts microscopically dilated cystic sweat ducts are visible throughout the corium. In most instances treatment is not desired nor indicated.

Adenoma sebaceum originate from sebaceous glands Commonly observed are the senile sebaceous adenomas that affect predominantly the forehead and less frequently the

(7) Wisconsin M. J 58:99-106 February 1959

cheeks and chin. They are chamois-colored to brown papules, usually no larger than 3 mm., with a rolled border and a central depression. Telangiectasias may course over the surface of these lesions. These adenomas are benign and their removal is prompted by cosmetic reasons only.

Similar lesions can be noted on the central portion of the face in children and nearby on the forehead and chin (Fig. 212, *C*). In association with tuberous sclerosis of the brain, mental deficiency and epilepsy, sebaceous adenoma is part of the syndrome epiloia. This is inherited through an incomplete dominant mechanism. Invariably, the patients die before age 20.

Some confusion might exist in differentiating trichoepithelioma (multiple benign cystic epithelioma) from the adenoma sebaceum as noted in childhood. Trichoepithelioma likewise has its onset before puberty and affects girls more commonly than boys. A hereditary pattern is present in this disease also. The individual lesions are minute pearly to pale yellow to pink tumors located symmetrically in the central portion of the face (Fig. 212, *D*).

Cylindroma has an anomalous place within this group of tumors of skin appendages because its exact origin has not been determined. The lesion occurs in groups as variously sized smooth, firm to hard nodules often located about the hair margin, thus aptly suggesting the term "turban tumors" (Fig. 212, *B*). The individual tumors are asymptomatic and grow slowly but may attain considerable size. Their removal is required only when the size interferes with the wearing of a hat, combing of the hair, etc. This skin tumor, referred to as cylindroma, should not be confused with cylindroma of the salivary glands, which is another entity altogether. Cylindroma is at times associated with trichoepithelioma and syringoma.

Cancer of Head and Neck: Plastic Surgeon's Viewpoint is presented by George V. Webster[8] (Univ. of California, Los Angeles). In cutaneous carcinoma of the face and neck, surgery, as opposed to radiation, is quicker, the cosmetic result is better and the width of excision and type of tumor can accurately be checked under the microscope. Even in radiation cures the scar often requires excision and later plastic repair. In the adenocystic type of basal cell carcinoma, radiation is

(8) West. J. Surg. 67:219-222, July-Aug. 1959.

rarely effective In widespread disease or in presence of general contraindications to surgery radiotherapy has its greatest usefulness

When the operation is being done in critical areas to extirpate recurrent disease a temporary graft of nonmatching readily available thick split skin graft is best. Any further recurrence can easily be observed and good repair materials of matching full thickness skin or pedicle flap will not have been destroyed

Most squamous cell carcinomas can be well treated surgically, with or without contiguous lymph node dissections as indicated Massive extirpations of tumor and nodes in continuity can be effected if the surgeon is prepared to carry out adequate reconstruction

When suspicion has been aroused by the appearance of a mole, some growth or pigment change bleeding or irritation from friction barbering or a razor the lesion is treated from the first as though it were a malignancy A wide zone of safety is outlined and a graft is applied without hesitation where necessary

Concurrent lymph node dissection for melanoma is decided in each instance on an individual basis Points in the decision are the duration and pathologic character of the lesion accessibility of a group of well-defined lymph nodes draining the site of the primary and suspicion of metastasis or palpable node

► [The author gives a concise presentation of the basic fundamentals in the proper management of carcinoma of the head and neck. He clearly points out the advantages of surgery over radiation therapy in the resolution of these cases. All too frequently unnecessary complications can be avoided by resolving these problems by surgery instead of attempting to care for them by means of radiation therapy—Ed.]

Management of Carcinoma of Lip is described by F X. Paletta[9] (St. Louis) Surgical treatment of carcinoma of the lower lip controls the early and not clinically apparent lesions in addition to quickly removing extensive lesions Surgery makes a specimen available for thorough study as to adequacy of treatment. The wounds usually heal in a week. Most of the persons treated are outpatients and the procedure is done with the region under local anesthesia.

About one half of the lip can be excised and closed without producing much of a deformity If more of the lip must be

(9) J Internat. Coll Surgeons 30 162 164 August, 1958.

sacrificed, replacement with lip tissue from the upper lip (Abbe flap) or the commissure (Estlander flap) will prevent the formation of a narrow flat lower lip

Patients with multiple lesions of the lower lip or a recurrent lesion in a previously irradiated area need to have the entire lip resected. The defect can be easily reconstructed at the primary operation using local anesthesia Reconstruction is best accomplished with use of tissue taken from the face and neck. The texture and color match are better when facial skin is used than when skin from other areas is used Results of lip reconstruction from pedicle flaps taken elsewhere are not as good There are two types of lesions in which delayed repair is advisable the extensive lesion and the lesion that shows rapid inflammatory type of growth.

Because cervical metastases develop from epidermoid carcinoma of the lip in only about 6% of the patients it is not necessary to resect the lymph nodes of the neck routinely However enlarged cervical nodes require neck dissection

Tumors of Mandible in Children were studied by Robert J Richardson David W Robinson and Frank W Masters[1] (Kansas City, Kans) Fibrous tumors of the mandible are common among children and occur at average age of 15 Except for periosteal fibromas the entities of ossifying fibroma localized osteitis fibrosa cystica central fibroma and fibrous dysplasia are probably all of the same fundamental pathology This process of unknown cause starts within the bone as a discrete lesion and is asymptomatic except for painless swelling Roentgen studies show localized well-defined areas of mixed opacity and radiolucency with some trabeculation Treatment consists of conservative surgical removal if the growth progresses In many discrete benign lesions watchful waiting is acceptable because the disease may not progress and little is gained by surgery Radiation has no place in the treatment.

Giant cell tumor may take the form of a centrally placed bone cyst or of an exophytic giant cell fibrous epulis The central type of tumor is relatively rare among children but has been reported This tumor is indistinguishable by x ray from other localized cystic changes in bone and therefore cannot be positively identified without biopsy Treatment consists of local curettage of the cavity

(1) Plast. & Reconstruct. Surg 23 576-583, June, 1959

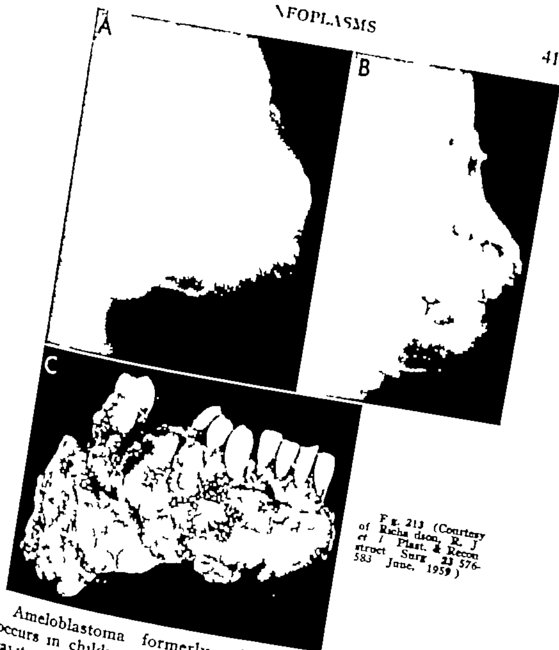


Fig. 213 (Courtesy of Richardson, R. J et l Plast. & Reconstruct Surg 23 576-583 June, 1959)

Ameloblastoma formerly called adamantinoma rarely occurs in children. X rays show a sharply defined cystic cavity often multilocular with trabeculation (Fig 213) This tumor cannot be differentiated from other cystic areas in bone without a biopsy Treatment of ameloblastoma consists of total removal of the local lesion with meticulous curettage of the lining of all locules Bone regeneration will be rapid if the lesion has been completely removed.

Eosinophilic granuloma has been reported in the mandible of a child as young as 19 months This local lesion is usually

part of a pathologic process involving multiple bones. The teeth over the lesion loosen, the gums are swollen and pus is present at the gingival margins There is a bad taste in the mouth and the tooth sockets heal poorly after extraction. X ray study reveals a sharply punched-out area 1-4 cm. in size with irregular edges Diagnosis can be made by biopsy only This process is often a part of the Hand Schuller Christian syndrome or Letterer Siwe disease No treatment is indicated

► [This group of tumors are most interesting and challenge even the astute surgeon. Diagnosis is difficult and always requires extensive study x ray survey and tissue biopsy An ameloblastoma is a capricious tumor and should be treated with great caution. Wide surgical excision which leaves a margin of uninvolved bone on either side is the treatment of choice. Unless completely removed, these tumors do recur and recurrence always approaches malignancy —Ed]

Treatment of Cancer of Paranasal Sinuses and Nasal Fossa. According to James W Hendrick[2] (Tuscaloosa Ala.) any patient who complains of dull persistent pain in the face or upper jaw that is more pronounced when the patient is prone may have a benign or malignant tumor of the paranasal sinuses Antral cancers that originate in the roof of the sinus invade the floor of the orbit (Fig 214) Those located in the medial area of the roof invade the lacrimal bone and extend into the sphenoid and ethmoid cells to produce lacrimation and lateral displacement of the eye. If the tumor originates in the lateral area of the roof of the sinus it extends into the temporal fossa producing medial displacement of the eye.

In general all patients with carcinoma of the paranasal sinuses and nasal fossa are treated with radiation and/or surgery Radiosensitive tumors i e. anaplastic epidermoid carcinoma transitional-cell epithelioma and lymphosarcoma, or tumors in patients with advanced disease or whose general physical condition will not permit radical surgery are treated with radiation alone

Radiation therapy may be administered in higher doses than formerly with present-day use of precision technics. Because of the anatomic formation of the maxillary antrum it is difficult to administer a homogeneous dose of radiation throughout the tumor bearing area Irradiation with conventional voltage using cross-fire technic may result in over treatment of one area and undertreatment of other areas and

(2) A.M.A Arch Otolaryng. 68 604-616, November 1958.

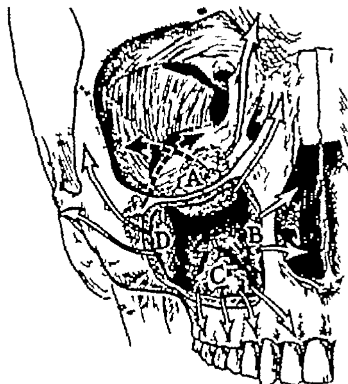


Fig. 214.—Diagram of tumors located in various areas of maxillary antrum and their pathways of extension. Tumors originating in roof of antrum (*A*) invade floor of orbit and extend into sphenoid and ethmoid cells, producing lateral displacement of eye. Tumors arising in medial wall of antrum (*B*) result in invasion of bone with projection into nares, producing bloody nasal discharge. Tumors arising in floor of antrum (*C*) invade tooth sockets, causing loosening of teeth with pain, broadening of upper gingiva and ulceration of palate. Tumors originating in upper lateral wall of antrum (*D*) invade temporal fossa and produce medial displacement of eye. (Courtesy of Hendrick, J. W.: A.M.A. Arch. Otolaryng. 68: 604-616, November 1958.)

permit viable cancer cells to remain. When irradiation is given in sufficient quantities to destroy cancer contained in a box of bone, such as the antrum, a residue of complications often results, i.e., necrosis, radio-osteonecrosis, sclerosis, obliterative endarteritis or chronic osteomyelitis, bringing about permanent changes in soft as well as osseous tissue. These complications, which are extremely painful and debilitating, may require surgery and antibiotic therapy.

Use of cobalt teletherapy or supervoltage irradiation, which eliminates use of conventional cross-fire fields, may permit more adequate irradiation of antral carcinoma. A cancericidal dose of 5,000-6,000 r delivered over 4-6 weeks should be attended with less radiation morbidity.

With surgical treatment, it is necessary to resect the superior maxilla and often to exenterate the orbital contents. If the lesion is limited to the floor of the antrum and there is

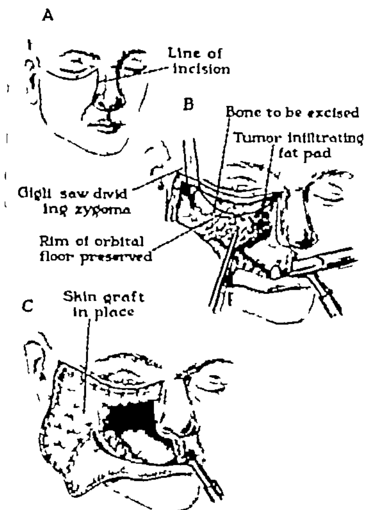


Fig 215 — A Fergusson s incision through which reflection of cheek and resection of superior maxilla are carried out for cancer of paranasal sinuses. B cheek flap turned back, demonstrating tumor infiltrating anterior antral wall with involvement of subcutaneous tissue. Broken line demonstrates where bone incision is made (with hammer and chisel) through middle of upper jaw to floor of nose, across nasal bone Infraorbital ridge is preserved and zygoma is severed with Gigli saw C superior maxilla has been resected. Split-thickness skin graft covers all raw surfaces of cheek, masseter muscle and pterygoid fossa. (Courtesy of Hendrick, J W: A.M.A. Arch. Otolaryng. 68 604-616, November 1958.)

no invasion of the orbital floor the resection is limited to the superior maxilla below the orbit. However if the lesion involves the orbital floor or if the tumor originates in the roof of the antrum or frontal sinuses the orbital contents must be exenterated The operative procedure is carried out through a Fergusson incision (Fig 215)

► [Another presentation which clearly reveals that many cases of advanced carcinomas of the face may be salvaged by means of heroic sur

gery It also clearly shows the advantage of surgery over radiation in these cases —Ed.]

Management of Extensive Malignant Tumors of Eyelid is described by Margo H Sinclair.[3] The two acceptable methods for treatment of cancer of the eyelids are surgery and radiation Unfortunately electrocoagulation is still used for smaller lesions but it is to be condemned because no specimen is available for pathologic examination there is no sure method for determining whether the destruction of the diseased tissue is adequate and the resulting skin scars can hide persistent and recurrent disease so well over a long period that clinical diagnosis is delayed

The functional and cosmetic results of surgery and radiation are about equally satisfactory in small and medium-sized lesions Choice of method will depend on other factors such as duration of disablement, hospitalization requirements and the patient's age For extensive tumors of the lower and upper eyelids surgery is preferable

Among the 28 patients with extensive carcinoma of the eyelids operated on at the M D Anderson Hospital and Tumor Institute of the University of Texas since 1950 in only 3 were tumors located in the upper eyelid in all of the others the lower eyelid was involved Of the extensive tumors of the lower eyelid 3 extended to the upper eyelid for a short distance at the outer or inner canthus In all instances resection of the involved eyelid was carried out until the check by frozen section showed a wide margin of uninvolved tissue around the tumor on the conjunctival side and on the skin side. If the adjacent skin of the temple or upper cheek showed malignant changes it was excised widely at the same operation.

Of the 28 patients 10 had no previous treatment. Of the others 7 had been treated by radiation or radium 7 had multiple radiation treatments 2 had electrocoagulation several times and 2 had inadequate surgery before admission. In the 10 previously untreated patients functional and cosmetic results after treatment by the Hughes technic were good. The almost normal appearance of the eyelid has remained good In one of these patients a recurrence or new tumor appeared, which was treated by radiation and the disease was controlled however functional and cosmetic results were infe

(3) Plast. & Reconstruct. Surg 23 589-594 June, 1959

rior Among the patients from whom all radiated tissue could be resected or in whom the radiation changes were not too extensive reconstruction still yielded fair results

Moles and Melanomas were studied by George T Pack[4] (Cornell Univ) The transformation of benign moles to malignant melanomas the rapidity of their growth, early dissemination and low rate of curability during pregnancy have not been generally known.

Malignant melanomas require an extremely wide excision of the tumor and the skin that surrounds it. Often the extent of the removal of skin necessitates immediate application of a skin graft The excision should go so deep as to constitute a three-dimensional dissection involving not only the skin, but also the underlying fat and fascia overlying the muscles to extirpate the adjoining lymphatics in the neighborhood of the melanoma

The principle of excision and dissection in continuity for primary and metastatic melanoma can be applied when the malignant melanoma is so situated in the skin as to be relatively and closely adjacent to the first relay of lymph nodes. The principle includes removing an elliptic segment of skin to include the primary melanoma the skin intervening between the melanoma and the axilla or groin or neck, and excision of the lymph node bearing region together with wide dissection of the underlying fat and fascia down to and exposing the muscles over this area The operation is completed by radical dissection of the regional lymph nodes that may contain metastatic melanoma

Sometimes the primary malignant melanoma is situated in the skin at a site remote from the regional lymph nodes that are involved by metastases e.g , a melanoma on the sole of the foot with metastases in the femoral and inguinal lymph nodes or a melanoma occurring in the nail matrix of the hand with metastases in axillary lymph nodes With such an enormous intervening distance between the primary melanoma and the metastases in regional lymph nodes it is not at all possible by any technical procedure to remove primary and metastatic foci with the dissection of all the intervening lymphatics between the two sites Yet there is a strong element of hazard in permitting any of the intervening lymphatics to remain

(4) Postgrad Med 25 263 266, March, 1959

Carcinoma Arising in Minor Salivary Gland Ducts of Lower Lip were found by Richard A Keffler (Lubbock, Tex.), Norman Lenson and Sheldon C Sommers[5] (Boston) in 6 men among 140 patients with lip cancer Age range was 53-88 average age was 70 Duration of the disease before treatment was noted as 6 months in 3 patients 1 year in 2 and 5 years in 1 A tobacco history was elicited in 5 3 smoked pipes 2 smoked cigarettes and 1 chewed tobacco Oral hygiene was noted as good in 4

Clinically these carcinomas resemble ordinary lip cancers except for their worse prognosis Pathologically, the carcinomas are characterized by (1) involvement of the mucous membrane surface of the lip without transitional changes of the adjacent overlying epithelium (2) deep invasion and frequent lymphatic spread, (3) histologically a sheetlike growth pattern of undifferentiated malignant epithelium with occasional tubule and duct formations (4) evidences of abortive secretion (5) a few keratinized cells and keratin foci without demonstration of any mucus production and (6) an increased likelihood of regional and distant metastasis

Unless contraindicated all were initially treated by U or V excisions and radical neck dissection was performed if adjacent lymph nodes were clinically suggestive of metastatic cancer Two patients were unsatisfactory for surgery and were treated by radiation receiving about 6,000 r in air Of the patients treated by radiation the immediate response was poor

Over all prognosis was unfavorable of the 6 patients 2 lived less than 2 years 2 lived 2 years 1 survived 2½ years and 1 died 4 years after the initial treatment.

Malignant Irradiation for Benign Conditions Bradford Cannon Judson G Randolph and Joseph E. Murray[6] (Boston) reviewed the records on 165 patients with disabling and life-endangering consequences from use of radiation in treatment of benign conditions In every patient, the irradiation had been accidental or administered for a benign lesion In each surgery was performed or recommended for the damaged tissues

The chief complaint of nearly one half of the patients was persistent ulceration One fourth listed pain as the chief

(5) Am. J. Surg. 97 79-83 January 1959
(6) New England J Med. 260 197 202, Jan. 29 1959

symptom which was promptly relieved by excision of the painful area Aid for cosmetic reasons was sought by 28 patients or one eighth of the total

There were 32 patients with plantar warts Surgery was indicated for the irreversible radiation changes in the foot, not for recurrence of the wart Most of these patients had multiple treatments with x rays Average time lapse from exposure to surgery was 5½ years Nineteen patients with abnormal skin conditions (eczema psoriasis lichen planus etc) treated with x rays had severely injured skin and soft tissue The mean latent period between exposure and skin breakdown among these patients was 14 years Of the series 14 of the patients had been given in infancy a small dose or doses of x rays for isolated hemangiomas The sequelae of irradiation for acne were particularly deplorable. Of 10 patients observed cancer had developed in 9

Cancer was found in 36 (22%) patients The interval between x ray exposure and establishment of diagnosis of cancer ranged from 5 to 50 years The average interval for the development of cancer was 28 years This observation emphasizes the slow but relentless progression to malignant change that can be predicted in a significant number of those more recently exposed Only by prophylactic excision of all severely injured skin can the malignant transition be avoided

Of the 36 patients with cancer in 14 the disease was of the basal-cell type. This is contrary to the accepted teaching that only epidermoid carcinoma is found in irradiated areas With one exception a physician s hand all basal cell lesions occurred on the face

► [An excellent discussion which presents numerous examples in which radiation may leave changes more disabling than the condition initially treated. It cites the high percentage of cases in which cancer develops following the application of radiation. I disagree with the premise that death from radiation necrosis is rare.—Ed.]

Nasal Glioma was observed by G H Morley and R. M. Cross[7] in a patient.

Girl at birth, had a soft, but solid, tumor (Fig 216) lying in front of the left inner canthus and obscuring the inner half of the left eye though entirely free from these structures. The lesion was spherical, 2 cm. in diameter and protruded externally from a relatively wide base in the region of the left nasal bone. The tumor did not pulsate nor vary in size and was not reducible Normal skin covered the base. The tu-

(7) J P th. & Bact 6 590 592, October 1958.

mor was removed surgically Convalescence was without incident.
Histologic studies of the tumor revealed normal skin. In the corium there was a diffuse unencapsulated mass of glial tissue that contained cells resembling fibrillary astrocytes with moderately dense oval nuclei and little cytoplasm. Other cells were atypical with one or more nuclei and appeared to be gemistocytic astrocytes There were no mitotic figures and none of the cells resembled ganglion cells The



Fig. 216.—Glioma before operation (Courtesy of Morley G. H., and Cross, M.: J Path. & Bact. 6 590-592, October 1958)

skin appendages were surrounded by a fine network of glial fibers and both were interwoven with collagenous strands containing blood vessels. The entire length of the stalk was sectioned and showed a similar appearance to that in the main tumor except that the proportion of collagenous tissue was greater Glial tissue could be identified to the limit of excision. There was no central cavity Diagnosis was astrocytic glioma.

The fact that only well-differentiated glial tissue was found in the tumor and the stalk supports the theory of a blastomatous condition

Malignant Melanoma Analysis of 135 Cases Robert B Clifton, Charles D Knight and W R Mathews[8] (Shreveport, La.) reviewed data on 135 patients treated before July 1 1957 and in all the tumors were histologically proved as melanoma. To evaluate results in terms of 5-year survival only the 111 patients seen before July 1 1952 were analyzed

(8) Am. Surgeon 25 189 193 March, 1959

Over all survival rate among the 135 patients was 29.7%

The authors advocate radical surgery as the best therapy available. This consists of radical excision of the primary lesion and this may require amputation Lymph node dissection in continuity if possible, is advised if areas of lymphatic spread are accessible and predictable. The efficacy of this procedure is controversial The finding of metastatic lymph nodes in melanoma as in other forms of cancer decreases the change for long term survival Therefore lymph node dissections prophylactic and therapeutic, are worth while in this disease.

Superradical surgery such as hemipelvectomy or interscapulothoracic amputation has been abandoned by the authors even though results were good

The patients were divided into two categories those who had inadequate or no treatment (78 patients) and those who had optimal or more radical treatment (33 patients) The 5-year survival rate for the 78 patients was 25 6% whereas for the 33 patients it was 39%

Pursuit of melanoma should be relentless even though the situation appears hopeless Among the unexplained aspects of the melanoma problem is the unpredictability of its life history or course in a specific patient It is well appreciated that many patients with extensive or disseminated disease possess considerable tolerance or resistance to its ravages and continue to live for many years Continued treatment of melanotic lesions as they appear is justified by whatever method is expedient because in many patients the therapy will aid in controlling the disease even when the outlook is exceedingly poor

► [This is a valuable analysis of a large series of cases of malignant melanoma It demonstrates the value of adequate surgery establishing a 13 4% improvement in survival rate over a similar group less aggressively treated —Ed]

COSMETIC

Problem of Facial Scars is evaluated by Raymond O Brauer[*] (Houston) What can the plastic surgeon really do stripped of all embellishments? Always realizing that mother nature is his greatest asset, the surgeon allows a

(9) Texas J M d 55 559 560 J ly 1959

proper time interval for all the reaction to subside before starting extensive reconstructive procedures or even the revision of simple scars From experience the surgeon knows that tissue obtained by undermining and advancement for closure of a depressed scar or closure by shifting of a local flap where there has been an actual loss of tissue is superior to any skin graft Local tissue is superior in color and texture to that brought from a distance. When facial scars are present only those that the surgeon believes can be improved not merely changed are subsequently revised When the scar crosses a flexion crease of the eyelids or passes from the cheek to the ala Z plasty is carried out with shifting of the two flaps to place the scar in the proper direction

When feasible the incision is kept as small as possible and is placed in a normal fold or crease hidden in front of or behind an ear or in the hairline to make it less conspicuous After careful closure with early removal of sutures the scar in time may be inconspicuous especially if the surgery was about the eyelids

The patients and the public should be informed that no scar is completely erased but is only made less conspicuous and the extent to which this is accomplished depends on the patient s healing and the surgeon s skill

► [A short, concise and exceptionally sound appraisal of basic problems in the management of facial scars. Of particular merit is the suggested advice which should be given patients relative to results to be expected.—Ed.]

Total Mammectomy with Plastic Reconstruction of Breast. John B Erich[1] points out that in many patients all of the breast tissue can be removed in such a way that a mammary prominence can be constructed on which the nipple and areola are transplanted as a free graft The technic used by Erich is that described by Malniac (Fig 217)

TECHNIC.—The areola and nipple are dissected free from the rest of the breast through an areolar incision about 3 cm. in diameter The areola and nipple are removed surgically as would be any full thickness skin graft by scalpel, not leaving any fatty tissue on the under surface of the graft. After dissection of the nipple and areolar graft, an apron flap of skin and fat is outlined on the anterior surface of the breast with a skin pencil. This flap extends in a curved line down to the areola from the mesial to the lateral extremities of the submammary fold. A similar flap is outlined on the undersurface of the breast. After surgically elevating these two flaps all bleeding vessels are ligated. Between the flaps the mass of breast tissue with attached se

(1) Proc. Staff Meet. Mayo Cli 34 138-14 Ma 4 1959

ments of skin and fat is dissected free from the underlying pectoral fascia and is discarded (*B*)

Reconstruction of a mammary prominence may be effected by turning the lower flap of skin and fat up under the anterior flap (*D*) Before burying the lower flap under the anterior pedicle, the epithelium must be removed from the lower flap (*A* and *B*) Erich prefers to de-

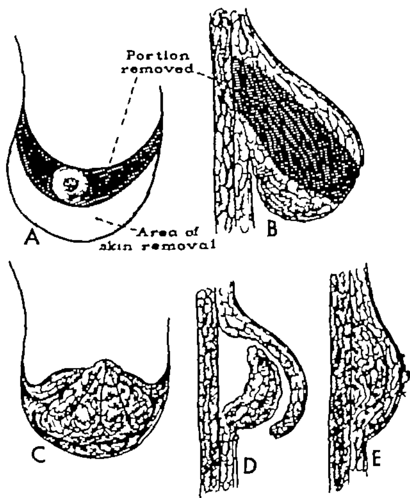


Fig 217 Total excision of mammary tissue *A* and *B* leaving superior and inferior flaps of skin and fat. Nipple and areola are excised as free graft and epidermis on lower flap of skin and fat is excised. *C* lower flap of dermis and fat is gathered in vertical folds to form central prominence and flap is tacked down with chromic catgut sutures to chest wall under anterior apron flap of skin and fat. *D* lateral views show how lower flap of fat and dermis is turned upward and under apron flap of skin and fat. *E*, lower flap tacked down to anterior chest wall with chromic catgut sutures. Anterior flap is sutured to skin along submammary fold, and nipple and areola have been transplanted and sutured down in proper position on reconstructed breast. (Courtesy of Erich, J B Proc Staff Meet. Mayo Clin. 34 138-142, Ma 4 1959)

epithelize the flap down to the submammary fold with a scalpel and to dissect off the epidermis as for a free full thickness skin graft. The lower flap of fat and dermis can then be turned upward and gathered in vertical fol t rm a central prominence that is tacked down to

the pectoral fascia with chromic catgut sutures (C) The anterior flap is brought down to cover the lower flap and sutured along the submammary fold (D and F)

► [One seldom finds a patient who reflects more gratitude than the woman with enlarged, pendulous breasts who has been given relief by surgical reduction of the excess tissue Satisfactory surgery gives both psychic and physical relief. The author has presented a method of correction which is simply executed and which should offer excellent results —Ed.]

Complications of Rhinoplasty I Skin and Subcutaneous Tissues. The complications that according to Mar W Mc Gregor Gerald Brown O Connor and Sherman Saffier[2] may arise in various rhinoplastic procedures include (1) failure of the skin to shrink to conformity with the underlying bone and cartilage (2) preoperative existence of cutaneous reactions such as dilated nasal skin capillaries (3) slight local necrosis of the skin in the nasal tip or on the lateral aspect of the nasal bones either of which may be due to inept surgical handling in the past (4) dark pigmentation of the lower lids (5) webs in the vestibule of the nose (6) hemorrhage into the space between the dermis and the bone or cartilage framework of the nose with eventual scarring and deformity and (7) tumor like swellings in the aforementioned space on the dorsum of the nose

Many of these conditions may exist before treatment without having attracted the patient s attention It is therefore necessary for the plastic surgeon before consenting to operate, to point them out and explain them thoroughly to the patient, who otherwise may hold him responsible for their presence. No plastic operation should be performed on persons with obvious insecure personality traits

► [The authors discuss many of the complications associated with nasal surgery These are sufficiently common to concern all physicians performing this type of surgery It is far better to discuss the possibilities with a patient before surgery than to attempt to explain them after complications have developed.—Ed.]

Buccal Incision for Chin Implants is advocated by D Ralph Millard Jr[3] (Univ of Miami) Receding chins are often accentuated by protruding upper teeth and a lax lower lip After chin implants the protrusion of the upper teeth is partially camouflaged and the implant beneath the chin skin takes up the slack of the lower lip When a receding chin is riding under the shadow of a large nose there is a relative exaggeration of both features The solution does not lie in

(2) J Internat. Coll. Surgeons 30 179-185 August 1958.
(3) South. M. J 52 1371 1374 November 1959

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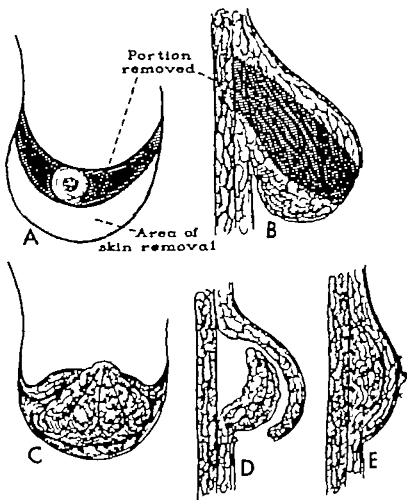


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(2) J Internat. Coll. Surgeons 30 179 185 Aug t 1958.
(3) South. M. J 52 1371 1374 November 1957

bolstering the chin until it juts equal to the prominent nose or in trimming the nose to insignificance to balance the diminutive chin Rather the solution lies in a compromise—to build up the chin to fit the rest of the face then to reduce the nose to match the new chin

Homologous rib cartilage easily kept in a bank and carved to shape avoids a second operation on the patient Insertion through a buccal incision produces no visible scar Infection is prevented by a mucosal flange flap closure in two layers postoperative pressure and antibiotics

Certain precautions must be taken when a cartilage implant is inserted through a buccal incision Dental hygiene is mandatory Because the subcutaneous pocket is in continuity with the oral cavity the possibility of saliva leakage must be avoided Therefore the buccal incision is not made in the depth of the sulcus where saliva can pool on the suture line, but rather up on the lip side so that a 1-cm mucosal flange flap is developed The incision is made the same length as that of the cartilage and is extended downward leaving a generous pad of subcutaneous tissue over the mandible until arriving at the predetermined position for the cartilage graft. Then dissection is carried to but not beneath the mandibular periosteum and the pocket is tailored to the exact size of the implant.

► [The advocated approach for cartilage implants into a buccal pocket is direct and simple. Despite the incision above the buccal gutter for avoiding contamination, the factor of gravity still exists to increase the hazard of downward drainage with impending infection. This is avoided if a skin incision beneath the chin is utilized. Also, simple contamination from mouth bacteria is avoided.—Ed.]

MISCELLANEOUS

Management of Donor Site is described by Robin Anderson Eldon R Dykes and Mary M Martin.[4]

TECHNIC —Immediately after cutting of the skin graft, a single layer of almost dry fine-mesh, petrolatum gauze is applied to the donor site An occlusive dressing of the usual type is applied with moderate pressure to control initial oozing and protect the donor site in the immediate postoperative period In 12 24 hours, the occlusive portion is removed, leaving only the single layer of greased gauze attached to the raw surface This is accomplished without difficulty but with some discomfort to the patient. The donor site is kept exposed to

(4) Cleveland Clin Quart 26 106-112, July 1959

air and within another 24 hours a thin pliable coagulum develops of which the fine mesh gauze has become an integral part. The gauze provides a structural framework for the clotting process and prevents subsequent cracking of the coagulum During this second 24 hours there may be minimal oozing from the gauze surface, which can be gently removed with a gauze sponge without injury to the underlying raw area. The coagulum rapidly becomes firm and by the end of the 3d day is immune to the usual trauma of bed activity and early ambulation.

The edges of the coagulum which gradually loosen as healing takes place, are kept trimmed The coagulum is allowed to separate spontaneously without manual assistance. This eliminates the tearing of newly formed epithelium which commonly occurs when the usual gauze dressing is removed. This process may be completed within a week or may require several weeks depending on the thickness of the original graft.

About 1 400 donor sites were managed by this gauze-coagulum method. There was no instance in which the entire donor site had become wet, even in the uncooperative patient, and over all incidence of complications requiring treatment was less than 5%

In general healing of the donor site was not slowed by elimination of the pressure dressing Pain to the patient was reduced significantly particularly that secondary to surface infection.

Studies in Metabolism of Trauma II Treatment of Burns in 11 patients is described by J U Schlegel and Hans Jörgensen[5] (Univ of Rochester) The patients were placed in a room with constant temperature and humidity as soon as possible after hospitalization For adults the temperature was kept at 24 C with humidity of 50% and for children at 20 C with humidity of 50%

The patients were weighed on a Toledo bed scale at 9 a.m every morning Metabolic studies were done on a 24-hour basis from 9 a m to 9 a m

In most of the burned patients fluids were given at least for the first 24 hours on the basis of the Brooke formula, except that the dextrose and water were given with 4% urea added and often in excess of 2 000 cc. the amount usually determined by urinary output. In 2 patients treatment had been started and maintained elsewhere for the first 24 hours so that urea-containing solutions were given only from the 2d day on. The last patient treated was given saline and colloids only as needed to maintain blood pressure whereas uri-

(5) Ann. Surg 149:252 266, February 1959

nary output was maintained at 50-100 cc./hour with 4% urea in dextrose and water

By administration of 4% urea in 5% dextrose in water solution diuresis could be maintained and established in patients with normal kidneys and normal blood pressure. Replacement therapy to satisfy the obligatory burn edema was successfully accomplished by giving plasma, Dextran or saline to maintain vital signs whereas urinary output was maintained at a high level by administration of 4% urea solutions

Establishment of osmotic diuresis by administration of a solution containing urea in a 4% concentration is a physiologic way to overcome obligatory antidiuresis resulting from thermal injury If treatment with intravenous urea is initiated early enough and if urine osmolality is high, it is simple to avoid renal damage and avoid excessive edema.

The authors administered urea-containing solutions to hundreds of surgical patients and never found any toxic effect even when the blood urea concentration was extremely high. However in renal damage when urine osmolality is low i e relative to that of serum it is doubtful that much can be accomplished by administration of urea Excessive amounts of urea-containing solutions in such instances may be toxic not due to the urea but simply to the volume of fluids administered

► [An excellent study of the metabolic changes associated with trauma. A thorough knowledge of these changes is necessary in the proper treatment of wounds.—Ed.]

Vascular Augmentation of Pedicled Tissues Demonstrable by Arteriography and Injection Mass Richard B Stark and Clayton R. DeHaan[6] (St Luke's Hosp New York) compared the vascular changes in pedicled tissues that occur as a result of aging without treatment with changes that occur in the wake of vasodilatation induced by histamine iontophoresis

The vascular supply to the skin is composed of branches of vessels that supply muscles These branches penetrate the subcutaneous tissue as the main cutaneous arteries and veins and these enter the deep dermis via the reticular layer Here they anastomose with one another forming the cutaneous network These vessels traverse the reticular layer of

(6) Plast & Reconstruct. Surg. 24 19-23 July 1959

the dermis and enter the papillary layer of the dermis where they run parallel to the skin surface giving off multiple small vascular tufts to the dermal papillae These connected tufts form the subpapillary plexus

The morphology of the cutaneous arterial network might be likened to a candelabrum that from the reticular stem gives off 10 to 12 vascular tufts to the rete pegs of the dermis This vascular branching takes place in three dimensions These far flung vascular connections of the subpapillary plexus account for the ability of the skin to survive subtotal avulsions and wide surgical undermining without necrosis

The vascular changes that manifest themselves on arteriography after formation of a tubed pedicle that was not treated are most pronounced during the 2d week of its existence. They consist of vascular hypertrophy and by the 10th day an increase in vessel length is manifest This lengthening of vessels offsets twisting and stretching of vessels that may accompany transplantation leading to ischemia The vascularity of untreated tubed pedicles diminishes after the 2d week of their existence

Histamine administered by iontophoresis enhances the vascularity of tubed pedicles in several ways It produces a startling hypertrophy of existing vessels and also pronounced hyperplasia of the subpapillary dermal plexuses not otherwise visible on arteriography In addition histamine establishes an astonishing number of new collateral vessels After transplantation there often is insufficient efferent circulation which leads to venous stasis thrombosis and infarction of the tubed pedicle—a phenomenon lamented by patient and plastic surgeon alike By virtue of the dilated subpapillary loops an enlarged turn around circulation is afforded tubed pedicles that improves efferent flow by eliminating the block at the capillary venule loop

Studies in Wound Healing.—*I Contraction and wound contents* are discussed by Hermes C Grillo George T Watts and Jerome Gross[7] (Boston) Full thickness skin defects in mammals heal in part by gradual approximation of the wound edges a process observed as a reduction in wound area and described as contraction The completeness of the process depends on many factors such as location of the

(7) Ann. Surg. 148 145-152, August, 1958

wound size the mobility of the skin and underlying tissues of the particular animal Contraction has generally been attributed to changes in the granulation tissue of the wound bed These have been described as tensile forces originating from collagen formation with subsequent fiber shortening, from diminution in wound contents or from an as yet undefined mechanical pull of the granulating mass

The authors tried to define more precisely the changes occurring in the composition and amount of the granulation tissue and to correlate this with the progress of the contraction process

Determinations were made of hydroxyproline (collagen) hexosamine (glycoproteins mucopolysaccharides) tyrosine (noncollagenous proteins) water and total tissue weight for the content of open healing skin wounds in guinea pigs and compared with the rate of wound contraction Rapid increase in total wound content occurred from the 5th to 8th day followed by an equally rapid fall that began to level off on the 10th day Wound contraction progressed continuously during this period of rapid flux of wound content. These results are not consonant with an obvious causal relationship between total wound content and contraction.

The water content of the wound tissue fell gradually over 30 days by only 4% Water resorption is therefore not a cause of wound contraction

The total amount of collagen in the wound increased rapidly from the 5th day to a peak at 8 days followed by a rapid fall. This again is not reflected in the contraction process.

Hexosamine concentration decreased continuously from the level of normal serum to that of normal skin This suggests that the wound hexosamine is mainly a measure of early exudate and is not evidence for an early 'productive phase" of wound healing Tyrosine concentration diminished similarly

II Role of granulation tissue on contraction is evaluated by Watts[8] and co workers Morphologic studies of contraction in healing skin wounds have led to the widely accepted hypothesis that the machinery for contraction lies in the granulation tissue The component of this newly forming tissue implicated most often has been the collagen fiber

Excision of central granulation tissue from a contracting

(8) Ann. Surg 4 160 August, 1958.

open skin wound in normal guinea pigs did not interfere with the rate or extent of contraction Excision of the wound edge caused immediate distraction of the wound and delay in contraction. Separation of the advancing skin margin from the wound base inhibited contraction

These results showed that the contraction process in full-thickness skin wounds is not caused by the granulation tissue filling the center of the wound Neither are the edges pushed in by a process occurring in the peripheral tissue In fact there is a steady tension tending to distract the wound Only manipulation of the wound margin interfered with contraction

The machinery of contraction must therefore lie in a narrow zone underlying the advancing skin edge the picture frame. This thin strip of new formed connective tissue firmly binds the wound edge to the fascia of the wound base Histologically it is an extremely cellular mass containing a little collagen but consisting mainly of fibroblasts The inward moving "picture frame pulls the skin along with it The movement may be produced by directional mass migration of connective tissue cells Such migrations are well recognized in embryogenesis and have been described for epithelial cells in healing skin wounds in amphibia A rim of contracting connective tissue has been described by Dann *et al* but a sphincter mechanism such as they proposed would not produce the stellate type of final scar nor would separating the margin from the base interfere with contraction in the manner observed in this study

It is unlikely that only one process occurs in wound contraction. Probably in the later stages of cicatrization a different mechanism is at work. The ultimate size and shape most likely depends on scar tissue and its collagen component. It is probable, too that in the earliest phase before new connective tissue appears the contraction is of a different type related to scab formation and drying

Injuries to Hand from Homemade Rockets according to F Augustus Arcari Robert D Larsen and Joseph L. Posch[9] (Detroit) are becoming much more frequent. In the first 6 months of 1958 8 severe injuries were encountered in the Detroit area alone. In treatment function is the cardinal aim and prehensility its most important expression To this end

(9) Am. J Surg 97 471-476, April, 1959

preservation of the thumb and an opponent is mandatory Satisfactory manual function implies a minimal level of sensory acuity Therefore the next important task is the reestablishment of neural continuity

Even though there is reasonable certainty that a traumatized digit is going to hinder future function it is just as reasonable to preserve the member as a living tissue bank from which valuable skin may be removed and grafted to other less severely deformed but denuded digits

Tendon repair as a primary procedure in massive destructive injuries is hazardous In selected patients primary repair of the extensor tendons may be attempted Internal fixation of bone using Kirschner wires lengthwise or as cross stabilizers is the most satisfactory method of dealing with comminuted and open fractures allowing early active manipulation of uninjured or less severely injured digits Nerves torn in association with loss of terminal portions of digits should be transected short of the final tip of the digit to prevent formation of painful terminal neuromas Tendons bones and joints should always be covered at the primary procedure. Lack of skin protection will result in a devitalized tendon within 24 hours

Inevitably more or less scarring and contracture develop in the course of healing Therefore the hand must be dressed in the position of function Scarring and contracture draw much of their potentiality from edematous fluid Maintenance of the hand above the elbow and the elbow above shoulder position is one step in the management and prevention of these complications Infection by aerobic and anaerobic organisms requires constant attention.

In the postoperative period, before grafting and reconstructive procedures it is important to maintain remaining function and encourage the use of the more definitively repaired structures.

► [Perhaps more good would be accomplished if greater emphasis was placed on the danger of homemade explosive and availability of fireworks rather than on excellent surgical management. I am convinced that a program designed to develop more articles and editorials revealing the great dangers associated with homemade rockets and fireworks would reduce associated deformities more than all the excellent presentations on surgical management

This article is an excellent one in the latter category —Ed.]

Endotracheal Anesthesia in Pediatric Plastic Surgery Special Problems and Their Management were studied by

Raymond D Sphire[1] (Grace Hosp, Detroit) Atropine is to be given to all who are to receive anesthesia Patients who are to receive rectal Pentothal should have atropine but no morphine Demerol or other rectal barbiturate All other patients should have morphine or Demerol and atropine plus suppository Nembutal or Seconal No morphine or barbiturate is to be given to patients under age 6 months Rectal suppositories of Nembutal or Seconal are to be given 90 minutes before operation Demerol or morphine and atropine are to be given hypodermically 60 minutes before operation

The child's size is important in determining the type of anesthetic apparatus to be used It cannot be bulky or cumbersome.

For induction of anesthesia Vinethene dropped on a four layer gauze mask, with 300-500 cc oxygen flowed under the mask via a catheter, is the method of choice This is quickly followed by ether and intubation if indicated In a child of 2 years and more, if there is an accessible vein intravenous Pentothal induction is performed Usually 30-60 mg is sufficient to produce sleep and this is followed immediately by 10-30 mg succinylcholine (short acting muscle relaxant) through the same needle. The child is ventilated with 100% oxygen, then intubated If intubation is not indicated the Pentothal is followed by open drop ether or an insufflation technic. For maintenance of anesthesia, ether with high concentrations of oxygen is the agent of choice

Successful endotracheal anesthesia depends on certain prime factors use of properly cleaned endotracheal equipment use of tubes of the proper size avoidance of forceful or hurried intubations avoidance of excessive motion of the tube by proper fixation and use of properly designed laryngoscopes as opposed to the large heavy instruments used in adults

In all pediatric patients a stethoscope equipped with extra-long tubing is taped to the lateral anterior precordium In this manner not only are the heart sounds heard throughout surgery but also the breath sounds of respiration With brief experience the anesthetist soon learns to correlate changes in what he hears and such occurrences as surgical blood loss lightening of anesthesia accumulation of secre

(1) J Michigan M Soc. 58 1273-1 75 August, 1959

tions etc Changes in rhythm are immediately detected and if failure in circulation occurs there is no delay in establishing the presence or absence of a heart beat.

► [The author presents in detail the proper management of special anesthesia problems in children. He emphasizes that extreme care is necessary for the safety of a child while undergoing anesthesia. After reading this article, one is fully aware that the problems associated with anesthetizing a child are quite different from those encountered while anesthetizing an adult.—Ed.]

Antibody Response to Homografts II Preliminary Studies of Time of Appearance of Lymphoagglutinins on Homografting are presented by Paul I Terasaki[2] (Univ of California Los Angeles) Although a great deal of evidence indicates that serum antibodies do not play a role in rejection of homografts in the past few years some evidence has demonstrated passive transfer of immunity to homografts by serum Recently Harris and associates reported the destruction of homologous lymph node cells in vivo by the serums of animals into which leukocytes from the lymph node donor had been injected. An in vitro test for detecting antibodies directed against homologous tissue was described by Terasaki and associates With this method lymphocytes from the homograft donor were agglutinated by serum from the homograft recipient.

Skin homografts were sutured to the backs of adult chickens and 4-day-old chicks The serums of these animals were shown to acquire the ability to agglutinate blood lymphocytes of the skin donors This lymphoagglutinating activity of serum from homografted animals first appeared 2 weeks after grafting and reached a maximum at about 3 weeks Chickens into which pooled homologous splenic tissue was injected also produced lymphoagglutinins in 2-3 weeks The time of appearance of the lymphoagglutinating activity of the serum is consistent with the idea that it is caused by an antibody

Detection of lymphoagglutinins in the blood shortly after completion of sloughing of the skin suggests that these agglutinins may play some role in the destruction of grafts i.e. these antibodies may be absorbed by the skin graft as they act on the graft and may be spilled over into the circulation only after the graft has been destroyed. The author's findings can also be interpreted to show that lymphoagglu

(2) Am. S rg 25 896 899 November 1959

tinins do not play a role in rejection of homografts Although the 6 selected 4-day-old chicks sloughed their homografts as rapidly as did the adult chickens tested lymphoagglutinin titers were higher and appeared earlier in the serums of the adult animals However, it is possible that visual assessment of skin graft survival was not accurate and that the agglutination reaction was a more delicate index of the response to homologous antigens About one half of the animals which rejected homografts rapidly could not be shown to have lymphoagglutinins in significant titers

Attempt to Induce 'Pigment Spread" in Freckled Human Skin. Aodán S Breathnach[3] (St. Mary's Hosp Med. School London), points out that experiments have shown that white skin transplanted onto a pigmented area of a spotted black-and white guinea pig becomes blackened and that black skin transplanted onto a white area blackens the surrounding white skin This phenomenon, known as pigment spread, is an accelerated version of a more slowly occurring natural process It was studied in recent years by Billingham and Medawar and Reynolds who concluded that it is best accounted for on the basis of a process of infective cellular transformation." According to these investigators, pigment spread is mediated through transference of a cytoplasmic ingredient probably the melanogenic enzyme system from highly active black melanocytes of pigmented skin to neighboring nonactive melanocytes of white skin after which the latter become permanently transformed into the black variant type.

Breathnach did transplantations on a man aged 35, whose skin showed many areas of confluent freckling Three types of transplantations were performed (1) pieces of skin were removed from areas of confluent freckling on both upper arms and grafted onto recipient areas within pale abdominal skin (2) pale abdominal skin was at the same time grafted back to cover the donor areas on the arms Thus on the abdomen pigmented grafts were entirely surrounded by pale skin and on the arms pale grafts were entirely surrounded by pigmented skin. (3) In addition arm to-arm forearm grafting was performed in which an attempt was made to get a straight edge between the transplant and the differently pigmented skin of the recipient area. Trans-

(3) J Invest. Dermat. 33 193 201 October 1959

plants were regularly examined for evidence of pigment spread up to over 1 year

The freckles did not spread nor did pigment extend into pale skin transplanted onto an area of confluent freckling This resistance to pigment spread is similar to that encountered in black red skin of guinea pigs. Pigment spread in guinea pigs is more likely to be mediated through migration of melanocytes than through a process of infective cellular transformation

Plastic Operations on Eyebrows and Eyelids are discussed by Thaddeus J Litzow[4] (Mayo Clinic) A torn and displaced portion of the eyebrow that has healed in its new position disrupts the natural curve of the brow The displaced portion can be repositioned by an interchange of triangular flaps known as a Z plasty Partial or complete absence of the eyebrow requires replacement with hair bearing skin. The most expedient method is use of a hair bearing free-skin graft. Such a graft can be taken from the scalp behind the ear

A small epithelioma in the eybrow can be widely excised with a vertical incision Frozen sections will determine the adequacy of the excision Primary closure in vertical direction restores the continuity of the eyebrow Small benign tumors of the eyelids can be removed for biopsy with light electrocoagulation of the base of the wound Excision of epitheliomas calls for wider removal with greater sacrifice of tissue A fairly large epithelioma that requires sacrifice of the skin only can be corrected by a local sliding skin flap

A full thickness skin graft with a good color match is best suited to correct loss of a major portion of the skin of the eyelid by physical trauma or thermal burn

Many injuries to the eyelids sustained in automobile accidents are lacerations involving little tissue loss and no eye damage. Simple cleansing and closure with fine suture material preserving all viable tissue, is sufficient.

Correction of paralysis of the orbicularis oculi muscle requiring lateral blepharorrhaphy consists in denuding a measured length of the free edge of the eyelids and suturing the raw edges together

Emotional Disturbances of Burned Children. Joan Woodward[5] (Birmingham England Accident Hosp) studied 198

(4) Minnesota Med. 42:218-221 March, 1959
(5) Brit. M J 1 1009-1011 Apr 18, 1959

children aged under 15 years who had burns of 10% or more of the body surface and were inpatients during 1952-55 The mothers were asked to give an opinion about the emotional state of their child at the time of the investigation (1957 58) This information was compared with that on the state of the child before the burn insofar as the mothers could recall. Similar investigations were made of 608 siblings of the patients on whom the mothers also gave an opinion A further independent control group of 50 children was selected at random from the same districts in the city as the patients

Emotional disturbance attributed by the mothers to the accident and hospitalization existed among 81% of the patients Incidence of disturbance was not significantly different among the children whose burns occurred 4-5 years previously from those who were burned 2 3 years previously This high level of disturbance (81%) as compared with that among the control groups (7% and 14%) is striking Though there is nothing surprising about the symptoms which are fairly varied a fact of greater interest is their persistence for so long after the accident

Lack of parental visiting to those aged under 5 years significantly related to disturbance confirming the findings of others that for the child under age 5 separation from the mother is often a cause of emotional disturbance.

Causes of disturbance among burned children are not analyzable as specific factors Probably many causes differing for individual children combine in varying ways to create the disturbances This makes it difficult to suggest specific ways for modifying these disturbances

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